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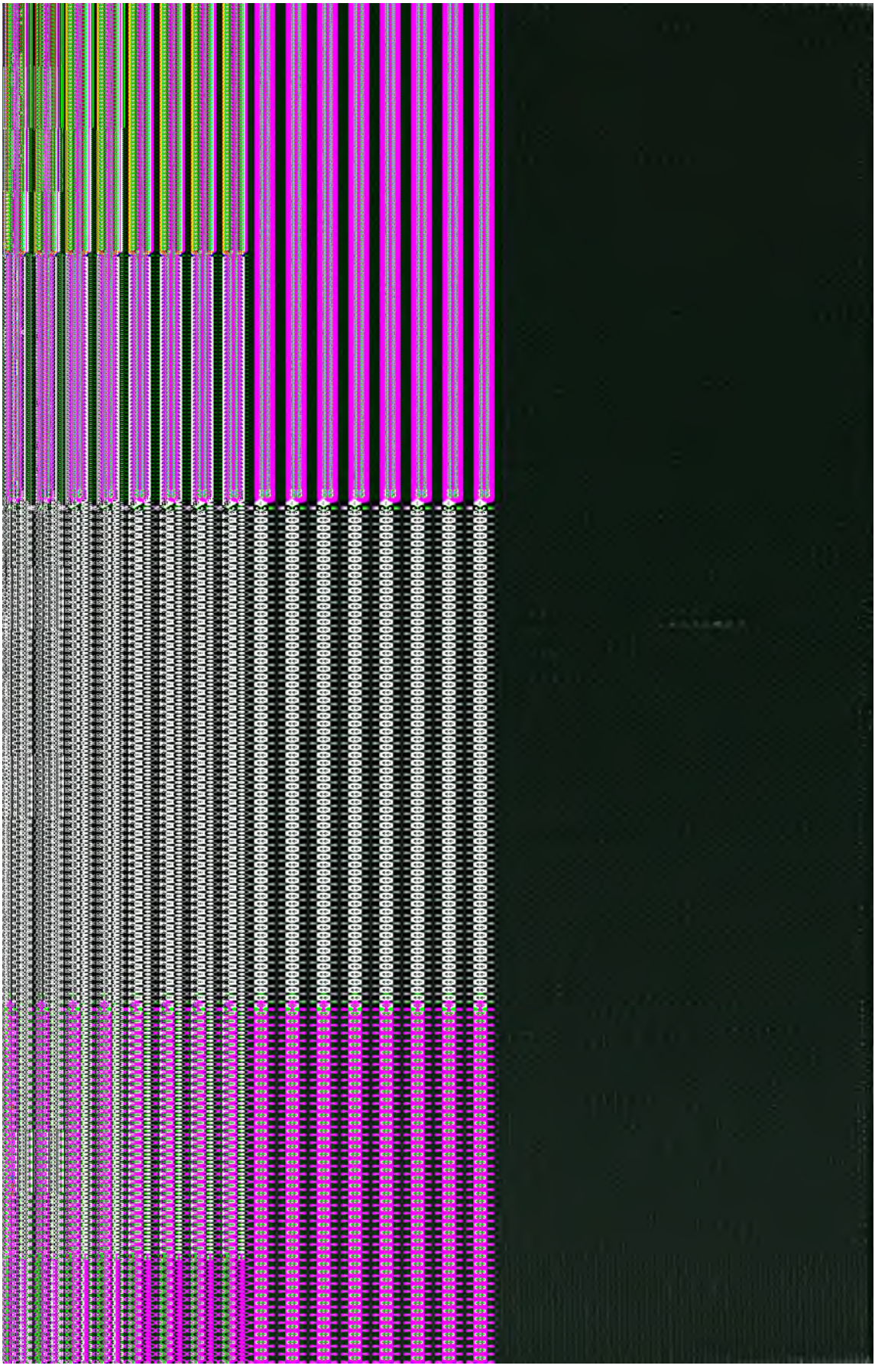

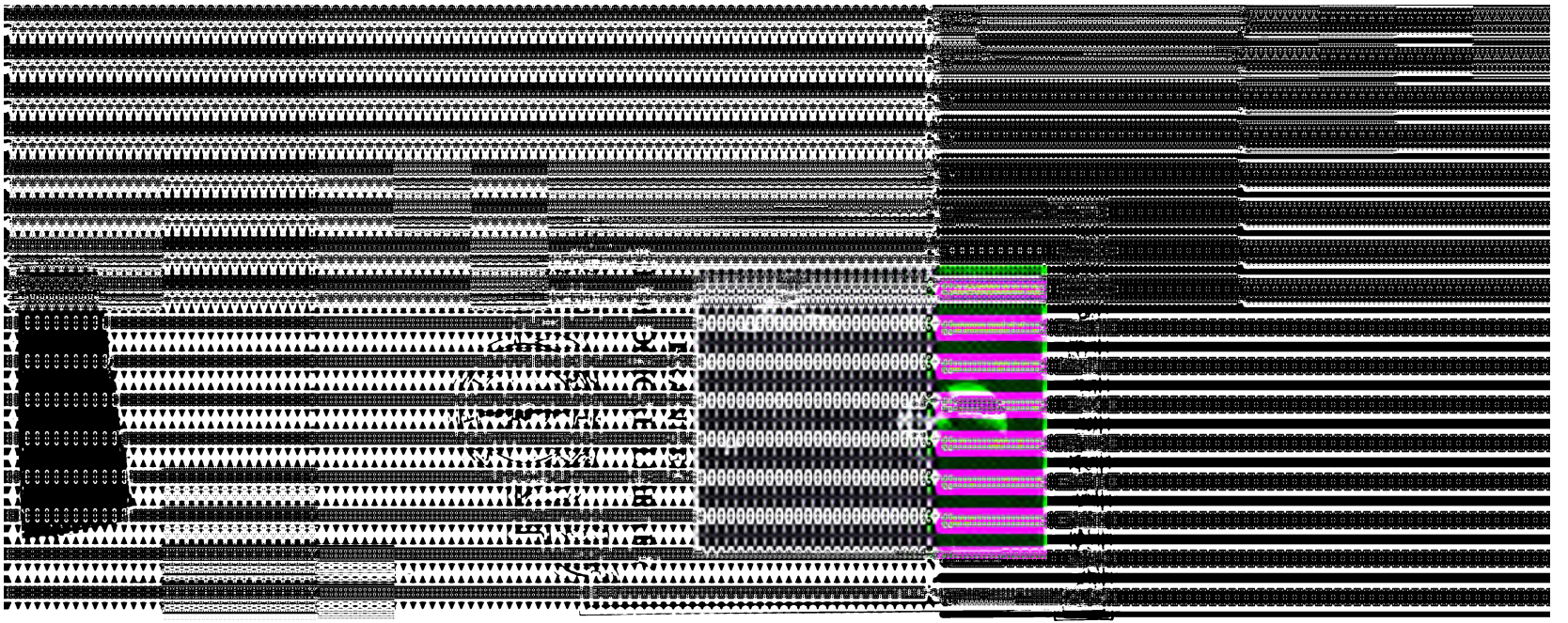

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To his Excellency H. H. MARKHAM, *Governor of California:*

SIR: The Trustees of the State Mining Bureau herewith submit their report, in pursuance of the Act of the Legislature approved March 23, 1893, entitled "An Act to provide for the establishment, maintenance, and support of a bureau, to be known as the State Mining Bureau, and for the appointment and duties of a Board of Trustees, to be known as the Board of Trustees of the State Mining Bureau, who shall have the direction, management, and control of said State Mining Bureau, and to provide for the appointment, duties, and compensation of a State Mineralogist, who shall perform the duties of his office, under the control, direction, and supervision of the Board of Trustees of the State Mining Bureau."

J. Z. DAVIS.
W. S. KEYES.
THOS. B. BISHOP.
W. S. LYLE.
J. E. DOOLITTLE.

SAN FRANCISCO, September, 1894.

REPORT OF TRUSTEES OF STATE MINING BUREAU.

Since the issuance of the last report of the Trustees, J. J. Crawford, M.E., has been appointed State Mineralogist, vice Wm. Irelan, Jr., M.E., term expired.

The Board of Trustees, in presenting herewith the report of the State Mineralogist, takes pleasure in bearing testimony to the zeal, energy, and fitness of Mr. Crawford and his corps of field and resident assistants, chief amongst whom is the able and painstaking Secretary and Custodian of the Museum, Mr. H. S. Durden.

The Board wishes also to express their approval of the work of the scientific assistants in the laboratory, Dr. Wm. D. Johnston and Mr. C. G. Schneider, as well as of the minor employés.

MUSEUM.

The rooms wherein are exposed the collections of the Bureau are, year by year, becoming more and more inadequate to a proper display of the valuable exhibits sent in by the field assistants and donated or loaned by the well-wishers of the institution. Hence, the Director of the museum has been compelled to look more to the improvement of the quality than the quantity of new offerings, and has, with the approval of the Trustees, returned to the lenders quite a number of exhibits not directly and strictly in line with the objects and purposes of the Bureau, bearing in mind always that *practical utility* is what the Legislature required and intended.

The attendance at the rooms, as shown by the register, from the date of the last report up to August, 1894, was 65,985.

There has been added to the exhibits a grand total of 1,038 specimens. Amongst the most noteworthy may be mentioned the following: A large glass model of the underground workings of the Eureka Consolidated mines, Eureka, Nevada, presented by the company and restored gratuitously, where damaged, by Thos. J. Read, M.E. and C.E.

A large model, showing actual method of timbering stopes, drifts, and a three-compartment shaft, by Mr. A. C. Hamilton.

A model of a sluice, as used in hydraulic mining, together with grizzly, undercurrents, etc., by Col. J. E. Doolittle.

A series of ten views of placer mining in California, taken in 1852, and believed to be the only set in existence.

Also a remarkably fine crystal of sulpho-carbonate of soda (Hanksite), presented by Mr. J. W. Searles, of the San Bernardino Borax Company.

LABORATORY.

Prospectors, miners, and others have availed themselves continually of the facilities of the Bureau for determining new and supposedly useful rocks, earths, ores, and waters. Since the last report, answers have been

sent by letter to 594 inquirers; 2,070 specimens have been examined and passed upon, and 660 determinations have been made to parties who have presented their specimens in person. In addition, many slides have been made for the classification of rock handed in by the field assistants, and between 60 and 70 complete analyses of coal and lignites have been made and published.

LIBRARY.

During the period since the last report of the Board of Trustees, but 48 volumes have been added to the library by purchase, owing to the limited amount of funds in hand available for that purpose. By contributions, some 50 bound volumes, mostly geological reports of the different States, and Government publications, have been received, and several hundred pamphlets from scientific societies, and many valuable statistical reports from abroad.

During the period above mentioned some 6,000 volumes of the State Mineralogist's report have been distributed throughout the State to individuals interested in mining enterprises, and about 1,000 to scientific societies and exchanges.

Of Bulletin No. 2, on "Methods of Mine Timbering," recently published, some 4,000 copies have already been distributed and are in active demand, and constitute a valuable and greatly appreciated contribution to the miners of the State.

The number of visitors to the Bureau seeking information and reference to the library is increasing, the monthly average indicating about 10,000 per annum.

The number of letters received seeking information on mining and scientific subjects number some 10,000, all of which were promptly answered and much useful information given to the general public.

FACILITIES FOR RECEIVING SPECIMENS.

The Trustees desire again to repeat their sense of obligation to Wells, Fargo & Co., for kindness and public spirit in transporting, free of charge, all packages for the use of the Bureau up to twenty pounds in weight.

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MECHANICS' PAVILION—COLUMBIAN EXPOSITION—MIDWINTER FAIR.

A preliminary exhibit of the specimens for the Columbian Exposition at Chicago, State of Illinois, was made at the Mechanics' Pavilion in the city of San Francisco in December, 1892. Early in 1893 an entire carload of specimens was packed, shipped, and delivered to the World's Fair Commissioners at Chicago. This collective exhibit of the Bureau embraced every known mineral product of the State of California, its lignites and rock oils alone excepted. The marble and so-called Mexican onyxes were particularly noticeable. Much to the regret of the Trustees, the specimens were divided between the Mining Building and the California State Building, which, in a measure, detracted from the impressiveness of the exhibits.

A small exhibit of seven cases was made at the Midwinter Fair, in Golden Gate Park in this city. That it was not more extensive was owing not merely to a lack of funds, since the most rigid economy was necessary, but chiefly because the exhibit as a whole, in the museum of the Bureau, was far more attractive, and besides was open to the public, free of charge.

LIST OF NEWSPAPERS RECEIVED IN EXCHANGE.

We are greatly obliged to the editors, etc., of the following list of papers, which have been forwarded free to the Bureau during the last two years:

Alameda Encinal.
Alaska Herald.
Amador Dispatch.
Anaheim News.
Anaheim Gazette.
Arroyo Grande Herald.

Bed Rock Democrat.
Blue Lake Advocate.
Bullion.
Burney Valley Bulletin.

Californian.
Calaveras Prospect.
Calaveras Citizen.
Central Californian.
Chino Valley Champion.
Citrograph.
Cloverdale Reveille.
Colfax Sentinel.
Colton Chronicle.
Colusa Sun.
Commercial Bulletin.
Contra Costa Gazette.
Contra Costa Democrat.
Corning Observer.

Daily Tidings.
Del Norte Record.
Democratic Banner.
Dispatch Democrat.
Dixon Tribune.
Dunsmuir News.

Eel River Valley Advance.
El Dorado County Republican.
Escondido Times.
Eureka Sentinel.
Evening Herald.

Ferndale Enterprise.
Four Corners.
Free Lance.
Free Press.
Fresno County Enterprise.
Fresno Expositor.
Fresno Republican.

Georgetown Gazette.
Gilroy Gazette.
Globe Review.
Gridley Herald.

Humboldt Standard.
Humboldt Times.

Inyo Independent.

Juneau (Alaska) Record.

Lassen Advocate.
Lewiston Journal.
Livermore Herald.
Los Baños Enterprise.
Loomiston Journal.
Los Angeles Express.
Los Gatos Chronicle.

Madera Mercury.
Mariposa Gazette.
Middletown Independent.
Mining Industry.
Mining World.
Mining Standard.
Mining New Era.
Mountain Democrat.
Mountain Messenger.
Monterey Cypress.

National City Record.

Napa Register.
New Era.
Nevada State Journal
Nevada News.
Nevada Transcript.
Nevada Evening Herald.
New North West.
Newcastle News.
Northwest Mining Review.

Oakland Enquirer.
Oakland Graphic.
Oakland Tribune.
Ontario Record.
Oroville Mercury.
Oroville Register.

Pacific Tree and Vine.
Petaluma Courier.
Petaluma Argus.
Placer Argus.
Placer County Republican.
Placer County Herald.
Pleasanton Times.
Plumas National Bulletin.
Political Record.
Porterville Enterprise.
Press and Horticulturist.

Redwood City Democrat.

Salinas Democrat.
Salt Lake Tribune.
Santa Cruz Surf.
Santa Barbara Morning Press.
Santa Inez Argus.
Santa Maria Times.
Santa Clara Journal.
Santa Rosa Republican.
San José Herald.

San Luis Obispo Tribune.
San Benito Advance.
Sacramento River News.
Selma Irrigator.
Shasta Courier.
Sonoma County Tribune.
Sonora Democrat.
Stockton Record.
Stockton Mail.
Stanislaus Weekly News.
St. Helena Star.
Sutter Independent.
Sutter County Farmer.
Sidney Mining Standard.
The Architect.
Town and Country (Sidney) Journal.
Trinity Journal.
Tulare County Times.
Tulare Register.
Twin City News.
Union Democrat.
Vacaville Reporter.
Valley Record.
Ventura Free Press.
Virginia Chronicle.
Visalia Delta.
Watsonville Transcript.
Western Watchman.
Weekly Standard.
Weekly Palo Alto.
Weekly Mercury.
Weekly Trinity Journal.
Weekly Visalia Delta.
Weekly Bed Rock Democrat.
Willows Journal.
Wood River Times.
Yreka Journal.
Yreka Union.

FINANCIAL ACCOUNTS.

From July 1, 1892, to July 1, 1893.

Balance on hand July 1, 1892	$6,803 26	
Paid into Mining Bureau Fund	3,102 00	
Bureau appropriation forty-fourth fiscal year	10,000 00	
Geological	15,000 00	
		$34,905 26

Contra.

Salary of State Mineralogist	$3,000 00	
Salaries of geological assistants	9,403 30	
Traveling expenses of geological assistants	1,965 50	
Clerical assistance geological work	679 75	
Sundries geological work	221 80	
Maps	3,371 60	
Rent of Bureau	3,000 00	
Salaries of Bureau	7,755 00	
Library of Bureau	405 27	
Laboratory of Bureau	106 41	
Freight and express of Bureau	255 68	
Minerals and museum of Bureau	385 68	
Postage of Bureau	219 33	
Sundries: telephone, fuel, water, gas, stationery, etc.	613 25	
Clerical assistance of Bureau	137 00	
		$31,519 57
Balance		3,385 69
		$34,905 26

From July 1, 1893, to July 1, 1894.

Balance on hand July 1, 1893	$3,385 69	
Paid into Mining Bureau Fund	2,480 60	
Bureau appropriation forty-fifth fiscal year	10,000 00	
Geological appropriation forty-fifth fiscal year	15,000 00	
		$30,866 29

Contra.

Salary of State Mineralogist	$3,000 00	
Salaries of geological assistants	10,645 00	
Traveling expenses of geological assistants	3,802 05	
Sundries for geological work	381 45	
Maps for geological work	193 90	
Rent of Bureau	3,000 00	
Salaries of Bureau	6,075 00	
Library of Bureau	398 28	
Laboratory of Bureau	105 38	
Freight and express	391 62	
Minerals and museum	97 45	
Postage	245 37	
Sundries: telephone, fuel, water, gas, stationery, etc.	509 98	
Clerical assistance	100 00	
		$28,945 48
Balance		1,920 81
		$30,866 29

REPORT OF THE STATE MINERALOGIST.

To the Trustees of the State Mining Bureau:

GENTLEMEN: In pursuance of the provisions of "An Act to provide for the establishment, maintenance, and support of a bureau to be known as the State Mining Bureau," etc., approved March 23, 1893, I herewith transmit my report for 1893 and 1894, which is the twelfth (or second biennial) report of the State Mineralogist.

It will be noted that the plan of the report has been somewhat changed, and repetitions from the former reports avoided as far as possible by reference to page and volume of previous descriptions of the same properties. Special technical papers have been issued, and others are about ready to be issued, in the form of bulletins, so that only those relating to the general features of mines, mining, or geology are incorporated in the main body of this report. By this means a marked reduction has resulted in the cost of printing, postage, etc., since many desire a copy of the report mainly for some one article specially useful to them. By thus segregating the special articles they may be supplied without sending the whole report.

As the general features of the counties of California, relating to their climate, topography, location, etc., have been so often described in former reports, it has been considered best, in the interest of brevity, to omit all references of this character, except to note the features of progress and establishment of new industries.

Instead of grouping all the county mineral products under the general county title, the following plan has been adopted: The descriptions of mineral properties, such as gold, silver, borax, coal, copper, chrome, lead, magnesite, petroleum, structural materials, etc., are arranged in separate chapters by subjects. Then the names of the counties in which such economic mineral substance occurs, and the names of the mines in such county producing it, follow each in alphabetical order. By this means the reader will be enabled to refer to what he seeks with the least possible trouble, and it may readily be noted just in what part of the State any one mineral substance is being mined. It should be stated that all the "mines" enumerated in this volume are "live" claims; that is, the assessment work required by law is kept up, even if they are not actively worked and producing. It is proper to note, however, that the statement of value of yield of the quartz, sulphurets, etc., is omitted, except where this has been verified by assay in the Bureau.

Many mines have doubtless escaped the attention of the field assistants; but, though it was impossible with the time at our disposal to visit them, it is hoped that, by the time the next report is issued, to obtain a complete list. A lack of funds prevented the assistants from taking the field until the latter part of May, 1893; and this year it was necessary for them to return early in August for the purpose of writing up their notes, and digesting them thoroughly for this report, which is

required by law to be submitted by September 15th. The field work was therefore necessarily curtailed to some extent both in 1893 and 1894. I would earnestly recommend that the Legislature amend the general law so that our *report* might be submitted on the 1st day of December. This would permit our assistants to take advantage of the best season of the year for field work and bring the report nearer up to date.

It is gratifying to note a very marked increased interest in gold mining during the past two years. The unexampled depression in silver mining, due to the decrease in value and the political vicissitudes of that metal, has turned the attention of many miners to the gold mining industry. The success attending the investment of capital in gold properties has been such as to warrant others following the example. The three properties now producing the largest amount of gold per annum in this State are all mines which were abandoned some years ago when the conditions were different, but, being thoroughly equipped and exploited by the investment of capital, were reopened and have attained the position noted.

The principal gold mines are in the northern and central portions of the State. Our annual gold product is largely from the quartz mines. Within recent years there have been so many improvements in methods and systems, that the cost in both the mining and milling of gold-bearing ores has been greatly reduced. As a consequence, gold mines are now worked at a profit which ten years ago could not be operated under the conditions then existing. There are, however, some thousands of "prospects," or undeveloped claims, which need capital for their proper exploitation. Experience has proved that in most instances it needs money to place a quartz claim on a paying basis, and the making of mines out of these numerous prospects is almost entirely a question of the investment of capital. They may prove of value, or valueless, but this can only be determined by work upon them.

The quartz mining industry of California is at present in a better condition than it has ever been before. The speculative features have been to a very great extent eliminated, and careful business methods adopted, resulting in more profitable work and greater confidence of investors. The gold mines of California are to-day in great demand, but this demand is more for developed properties than for mere "prospects" which may or may not become mines. The principal difficulty under which the mining community labors is in obtaining financial aid to develop these unopened claims. The capitalist will not invest until developments warrant an examination; and the prospector is himself unable to open the claim properly. It is for these reasons that there are so many unproductive "mines" in the various counties of California.

It is the object of this report not only to describe the condition of the older and more completely developed mines, but to refer as well to the smaller and less important claims, that attention may be turned to them by those desirous of purchasing such properties. Names of the owners of the mines, with addresses, are given, so it should be no trouble to open correspondence directly with the miners themselves.

The annual gold product of California has remained for some years between twelve and thirteen millions of dollars; but of late there has been such a revived interest in this branch of mining that the output will be materially enlarged. Many old properties have been reopened, and new ones developed among the quartz mines, and, as stated else-

where, upwards of forty hydraulic mines, which have been for years unproductive, are now being again actively worked, and numerous applications for permits to mine by hydraulic method are pending. This all tends toward an increased output of gold, and as more capital is invested, our annual gold product should be maintained for some years at fifteen to sixteen millions.

The product of silver in California is comparatively small, but the ores of the principal camp, Calico, San Bernardino County, can be worked cheaper than any silver ores on the Pacific Coast, so that some of the principal mines there have continued working, notwithstanding the fact that silver recently declined to the lowest point in value ever reached. This will account for the fact that during 1893, while silver mines all over the country were closing down, California more than doubled the silver output of 1892. The extensive silver belt in Shasta County is only partly developed. More or less silver is found with the gold ores throughout the State, but the entire silver product is now only a little over half a million a year.

The following tables, based on returns to the Director of the United States Mint, show the gold and silver product of California, by counties, for the past two years:

Gold and Silver Product of California for 1892.

County.	Gold.	Silver.	Total.
Amador	$1,210,383 45	$8,007 99	$1,218,391 44
Butte	316,998 50	610 00	317,608 50
Calaveras	794,531 31	24,441 32	818,972 63
Del Norte	4,102 00		4,102 00
El Dorado	198,321 54		198,321 54
Fresno	112,981 00	6 00	112,987 00
Humboldt	87,515 25		87,515 25
Inyo	13,930 31	35,995 34	49,925 65
Kern	107,738 92	72 49	107,811 41
Lassen	15,400 00		15,400 00
Los Angeles	219,204 00		219,204 00
Mariposa	81,011 94	67 14	81,079 08
Merced	445 96		445 96
Mono	396,296 85	70,006 59	466,303 44
Napa	795 69	22,893 47	23,689 16
Nevada	1,945,406 31	8,325 72	1,953,732 03
Orange	9,470 00		9,470 00
Placer	1,159,079 60	2,119 74	1,161,199 34
Plumas	432,294 62	11,730 84	444,025 46
Sacramento	121,900 00		121,900 00
Santa Barbara	896 00		896 00
San Bernardino	47,037 00	67,072 27	114,109 27
San Diego	396,517 98	2,050 75	398,568 73
San Luis Obispo	1,097 00		1,097 00
Shasta	574,832 88	7,977 29	582,810 17
Sierra	688,464 30	26 11	688,490 41
Siskiyou	1,013,331 78	56 16	1,013,387 94
Stanislaus	14,190 60		14,190 60
Trinity	1,466,603 05	168 33	1,446,771 38
Tulare	24,355 38	11 28	24,366 66
Tuolumne	1,092,549 55	911 63	1,093,461 18
Yuba	44,217 80		44,217 80
Totals	$12,571,900 57	$282,550 46	$12,834,451 03

Gold and Silver Product of California for 1895.

County.	Gold.	Silver.	Total.
Amador	$1,505,973 98	$5,230 56	$1,511,204 54
Butte	307,350 53	5,503 56	312,854 14
Calaveras	1,669,192 95	121 80	1,669,314 75
Colusa	300 00		300 00
Del Norte	10,352 00		10,352 00
El Dorado	294,610 26	1,219 80	295,830 06
Fresno	7,118 79		7,118 79
Humboldt	66,353 61		66,353 61
Inyo	25,944 67	52,474 62	78,419 29
Kern	83,665 72	1,754 00	85,419 72
Los Angeles	14,200 00		14,200 00
Madera	150,696 53	314 24	151,010 77
Mariposa	164,116 17	307 00	164,423 17
Mono	293,637 39	11,401 11	305,038 50
Nevada	2,067,203 22	1,229 27	2,068,432 49
Placer	1,351,249 70	616 00	1,351,865 70
Plumas	362,488 05	13 50	362,501 55
Riverside	42,412 41		42,412 41
Sacramento	90,090 57		90,090 57
San Bernardino	158,000 00	447,020 00	605,020 00
San Diego	105,860 33		105,860 33
San Luis Obispo	600 00		600 00
Shasta	500,407 01	8,577 26	508,984 27
Sierra	830,343 15	45 50	830,388 65
Siskiyou	799,108 07		799,108 07
Stanislaus	150 00		150 00
Trinity	1,122,994 50		1,122,994 50
Tulare	12,818 00		12,818 00
Tuolumne	354,734 72	1,392 50	356,064 22
Yuba	30,839 27		30,839 27
Totals	$12,422,811 60	$537,157 77	$12,959,969 37

It is not, however, in gold and silver alone that the mineral wealth of California consists. Many other substances are mined here, which even now bring the value of the mineral products up to about $19,000,000 or $20,000,000 per annum. Many of these are increasing in value year by year, as there is more demand and a better market for the product.

With the results for a single year in view, the great importance of the mining industries of California is apparent. As now conducted in the State, mining is not only a profitable but a safe industry, and the variety of products shows that it is a diversified one. Many thousands of men are directly employed and an immense amount of money put in circulation by the operations of our mines, quarries, etc. The mineral industry is one especially deserving the encouragement of the people of California, not only because it continues to be a source of great profit, but because, through it, the settlement of the State was originally brought about.

While only a part of the great number of mines in this State have been visited by our field assistants during the period under review, it is found that those mines, quarries, etc., referred to in this report give direct employment to 13,107 men, and doubtless, indirectly, to as many more. With a complete list of all the mines of the State, and an enumeration of their employés, such as it is the intention to make, this number will be largely increased.

The following statement shows the amount and value of all the mineral products of the State for the year 1893, this being based on direct returns from producers:

Mineral Products of California in 1893.

Antimony	50 tons		$2,250 00
Asbestos	50 tons		2,500 00
Asphaltum	9,150 tons		161,250 00
Bituminous rock	32,006 tons		192,036 00
Borax	7,910,563 pounds		593,292 00
Chrome	3,319 tons		49,785 00
Clays—			
Bricks	103,900 M	$801,750 00	
Pottery uses	24,856 tons	67,284 00	
			869,034 00
Coal	72,603 tons		167,555 00
Copper	239,682 pounds		21,571 00
Gold			12,422,811 00
Granite			531,322 00
Gypsum—			
Plaster of paris	180 tons	$3,245 00	
Wall plaster	240 tons	2,640 00	
Fertilizer	1,200 tons	8,400 00	
	1,620 tons	$14,280 00	14,280 00
Infusorial earth			2,000 00
Iron ore	250 tons		2,000 00
Lead	333 tons		24,975 00
Limestone—			
Lime		$288,626 00	
Flux		12,650 00	
			301,276 00
Macadam rock	271,500 cubic yards		256,875 00
Magnesite	1,093 tons		10,930 00
Manganese	270 tons		4,050 00
Marble			40,000 00
Mineral paints—			
Iron	30 tons	$900 00	
Litharge and red lead	148 tons	17,760 00	
Metallic	212 tons	4,135 00	
Ocher	200 tons	4,000 00	
	590 tons	$26,795 00	26,795 00
Mineral waters	383,179 gallons		190,667 00
Natural gas			68,500 00
Onyx			27,000 00
Paving blocks (basalt)	2,770 M		96,950 00
Petroleum	470,179 barrels		608,092 00
Platinum	75 ounces		517 00
Quicksilver	30,164 flasks		1,108,527 00
Rubble rock	99,600 tons		199,200 00
Salt	50,500 tons		213,000 00
Sandstone			26,314 00
Silver			537,157 00
Slate	3,000 squares		21,000 00
Steatite	400 tons		17,750 00
Total			$18,806,261 00

Since the preparation of the previous report issued by the Mining Bureau, there has been a marked and gratifying change in the conditions affecting the great hydraulic mining industry of California, some of the mines having again become productive. It is now possible to mine by the hydraulic method, under certain specified restrictions, in any part of the State; whereas, for many years before the passage of the so-called "Caminetti law," only those hydraulic mines tailing into the tributaries of the Klamath were enabled to carry on operations without danger of annoying suits at law. As a result, most of the larger and great numbers of the smaller hydraulic mines on streams

which drain into the Sacramento and San Joaquin rivers, or their tributaries, were closed by injunction, on the plea that the debris resulting from mining by this method was injuring the navigable streams or the farming lands along the banks.

In his inaugural address, in January, 1891, Governor H. H. Markham called the attention of the Legislature and the people of the State to the subject of the possible rehabilitation of the hydraulic mines, and the advantage to be derived by again bringing about an increased gold production from that source. He suggested that the long-pending controversy between the residents of the mountain and valley counties might be amicably adjusted, and that Congress should be memorialized, and our Senators and Congressmen asked to lend their aid in rehabilitating the industry.

In accordance with Governor Markham's suggestion, the Legislature adopted a suitable memorial, which was forwarded to Congress. The miners themselves, with a revived hope, took concerted action, which resulted in a Miners' Convention being held in the city of San Francisco and which was largely attended, not only by delegates from the mountain or mining counties, but from the valley or farming counties as well. An amicable understanding was reached, the miners asking only that Congress should devise some means by which the hydraulic mining properties could be worked without inflicting any of the injuries complained of in the past. A memorial to this effect was sent to Washington. A commission of Government engineers, appointed by Congress, had previously made an investigation of the region affected by the hydraulic mining debris, and reported that under certain conditions impounding dams for the debris could be constructed which would prevent most of the damage resulting from this method of mining.

The Caminetti bill was introduced, and the Legislature of this State, by a joint resolution, asked Congress to pass it or some similar measure, and it was finally passed, March 3, 1894. The essential feature of the new law is that the miners must impound the debris behind works constructed at their own expense, under the supervision of the Government Commission. They must obtain a license to do this, which may be revoked at the pleasure of the Commission, should the dams or other impounding works be found inadequate to protect the rivers.

While, under these limitations, the hydraulic mines cannot be made so productive as under former conditions, when the amount of gravel washed was not restricted, yet many of them which have been idle for years may now be worked, and this number will be gradually increased as new works are constructed. We should therefore see a material increase in our annual gold product from this source.

Under the provisions of this law (which is given in full in an appendix to this report) the President of the United States appointed the following members of the Corps of Engineers, U. S. A., as the California Debris Commission: Col. Geo. H. Mendell, Lieut.-Col. W. H. H. Benyaurd, and Major W. H. Heuer. The office of the Commission is room 92, Flood Building, San Francisco, and the Recorder is Lieut. C. E. Gillette, Corps of Engineers, U. S. A. Since the organization of the Commission, 76 applications for permits to mine by the hydraulic method have been received, and 42 permits issued. The mines operating under these permits (up to September 20, 1894) are as follows:

Herring Ravine	Brownsville	Yuba	J. M. Wetmore	Mar. 7, 1894	
Hustler	Cherokee	Nevada	Joseph Hustler	South Yuba	Aug. 13, 1894
Illinois Gold Gravel	La Porte	Plumas	H. Buckley and Louis Hillman	North Yuba	Jan. 31, 1894
Kelly Hill	T. 23 N., R. 6 E.	Butte	R. M. Mooer	Sacramento	Mar. 27, 1894
Manzanita	Sweetland	Nevada	Kate Hayes Mining Company	Main Yuba	May 1, 1894
Mateos	Howard Creek	Sierra	Manuel Mateos	North Yuba	Jan. 2, 1894
Motor	Brownsville	Yuba	Jas. Gordon	Yuba	Mar. 7, 1894
New York Gold Gravel	T. 21 N., R. 12 E.	Sierra	Westall & Hughes	South Yuba	Dec. 5, 1893
North Star	Mokelumne Hill	Calaveras	H. B. Havens and P. and B. McGuire	Mokelumne	Jan. 10, 1894
Oriental and Tahoe	Randolph Flat	Nevada	James Hackett	Yuba	Aug. 6, 1894
Polar Star	Dutch Flat	Placer	John Spaulding	Bear	Dec. 13, 1893
Pomroy	Ono	Shasta	John McGrew and Alonzo Engle	Cottonwood	Jan. 31, 1894
Red Hill	Ono	Shasta	Nathan Gardiner	Sacramento	Feb. 6, 1894
Schuyler	Igo	Shasta	Thomas White	Sacramento	July 23, 1894
Snow Bros.	Newtown	El Dorado	Snow Bros.	American	April 3, 1894

Spanish Hill Hydraulic	Placerville	El Dorado	El Dorado Water and Deep Gravel Mining Company	American	April 10, 1894
Spanish Hill Gravel	Placerville	El Dorado	Thos. Alderson	American	April 10, 1894
Spring Gulch	San Andreas	Calaveras	J. S. White	Calaveras	Mar. 13, 1894
Stewart Hydraulic	Placerville	El Dorado	John Melton	American	May 1, 1894
Tannery Ravine	Challenge Mill	Yuba	W. R. Reed	Yuba	Jan. 10, 1894
Union	La Porte	Plumas	D. W. Albert	Yuba	Mar. 27, 1894
Walker	Igo	Shasta	Alonzo Engle and Frank Walker.	Cottonwood	Jan. 31, 1894
Welch Placer	Carbondale	Sacramento	Columbia Gold Mining Company	Cosumnes	Feb. 18, 1894

During the past two years every county in the State has been visited by one or more of the field assistants, with the single exception of Modoc, where there is no mineral production as far as known.

During 1893 Mr. W. H. Storms visited Amador, Calaveras, Mariposa, Tuolumne, and the northern part of Fresno County; and in addition made an extensive special investigation of the gravel channel system of Calaveras County, the results of which are published in a separate article in this report. In 1894 he visited the counties of Alameda, Contra Costa, part of Los Angeles, Marin, Orange, Riverside, San Bernardino, San Diego, San Francisco, San Mateo, Santa Clara, Santa Cruz, Solano, and part of Sonoma.

Mr. W. L. Watts in 1893 made a special investigation of the natural gas, asphalt, and petroleum fields of the Central Valley of California and neighboring foothills, the results of which are incorporated in Bulletin No. 3, recently published by the Bureau. While engaged in this he visited all the counties in and bordering upon the San Joaquin and Sacramento valleys. In 1894 he completed the field work commenced the previous year, and visited the counties of Colusa, Fresno, Glenn, Kern, Madera, Merced, Sacramento, San Joaquin, Stanislaus, Tehama, Tulare, and Yolo; and also the oil regions of Los Angeles and Ventura counties and the gold fields of Siskiyou.

In 1893 Mr. E. B. Preston pursued investigations in Butte, El Dorado, Nevada, Placer, and Sierra counties. During 1894 his work was continued in Lassen, Lake, Napa, Plumas, Shasta, Siskiyou, Sutter, Trinity, and Yuba counties.

During 1893 Mr. H. W. Fairbanks, accompanied by Mr. R. P. Heagan, made a careful investigation of the geology and economic mineral features of part of El Dorado County, and of Monterey, San Benito, San Luis Obispo, Santa Barbara, and part of Ventura; and in 1894 the same class of work was continued in Alpine, Inyo, Kern (south of Tehachapi), Mono, and the northwestern portion of San Bernardino. The results of these investigations are published in the special chapters: "Geology of a Section of El Dorado County, embracing portions of Pekin, Agra, Green Valley, Pilot Knob, and Mud Springs Districts"; "Report on the Geology of Northern Ventura, Santa Barbara, San Luis Obispo, Monterey, and San Benito Counties"; and "Preliminary Report on the Mineral Deposits of Alpine, Inyo, and Mono Counties."

In this connection it may be stated that it is to be regretted that the appropriations are insufficient to enable the party engaged in purely geological explorations to camp and study the features of the districts carefully, instead of making what is now necessarily more of a reconnoissance. Much of the region investigated by Messrs. Fairbanks and Heagan is sparsely settled, and unless equipped with a complete camping outfit they are unable to spend the necessary time for study, away from the towns. It would be of immeasurable value to the State could a party be suitably equipped to follow up the work thus commenced, and during the winter pursue the petrographical study of the specimens collected.

Mr. F. C. Mathyas, acting under your special request to look carefully into the coal, iron, and platinum resources, visited, during 1893, nearly all the counties north of Tehachapi, and in 1894 traversed the rugged regions of Del Norte, Humboldt, and Mendocino counties. This report

on the coal fields of the State is of special interest, several new occurrences being described.

Mr. Russell L. Dunn has made a very careful study of the extensive fields of auriferous gravel in Siskiyou County, which are, as yet, but partly developed. The result of this work is printed as a separate chapter of this report under the title "Auriferous Conglomerate in California." Mr. Dunn finds an auriferous deposit there which he considers unique, and which is comprehensively an auriferous gravel bed compacted into a conglomerate. As it requires much the same methods of mining and treatment as the Transvaal (South Africa) conglomerate deposits, the name "auriferous conglomerate" is suggested. The chapter will be read with interest by the gravel miners of the State, and should Mr. Dunn's conclusions be found, through practical operations, to be correct, a new source of gold product will be added to the many varieties already found in California.

The chapter contributed to this report by Mr. Thomas H. Leggett, President and Manager of the Standard Consolidated Mining Company of Bodie, describes not only the electrical power plant at that mine, but several others now in operation. It will be found of great value to the mining community, giving as it does the results of practical experience in generating, transmitting, and applying electricity as a motive power for quartz mining, milling, etc.

In the preparation of this report, the assistants were all instructed to be as concise as possible in their statements. The manuscript was carefully scrutinized, revised, corrected, and condensed, and upon being properly edited was copied in typewriting.

It is to be regretted that in a few instances mine owners and others were indifferent to the objects and labors of the Bureau, and refused to give our field assistants any information concerning their mines or kindred industries. As it is the object of these investigations to ascertain the condition of the mineral industry of the State, with a view to disseminating information for its benefit, it seems strange that any one engaged in mining and the allied industries should refuse to put the Bureau in possession of such *general facts* as are asked for. It is not desired to make public any private business affairs, but simply to ascertain the general condition of the mines, etc.

The Goler and adjoining districts in Kern County have been discovered since the last report was prepared, and many mines are being worked, the production of gold being considerable.

Petroleum has been discovered within the city limits of Los Angeles, and many wells sunk and brought to a producing point. Field work has already been commenced on the study of the formation there by special request of the Los Angeles Chamber of Commerce, and it is hoped that in the course of eight or ten months the Bureau will be in a position to issue a bulletin on this field, and show by maps and text not only the relation of the Los Angeles oil fields to those of Ventura and Kern counties, but determine the formation beyond where oil is likely to be developed.

Bulletin No. 1 of the State Mining Bureau was published in 1888, being the description of certain "Desiccated Human Remains," in the Bureau museum, by Dr. Winslow Anderson. Three bulletins have been issued by the Mining Bureau during 1894, as follows: *Bulletin No. 2*, on "Methods of Mine Timbering," by W. H. Storms, Assistant in the Field;

Bulletin No. 3, "Gas and Petroleum Yielding Formations of the Central Valley of California," by W. L. Watts, Assistant in the Field; *Bulletin No. 4*, "Catalogue of Californian Fossils," by Dr. J. G. Cooper. There are prepared, but not yet printed, two more bulletins, viz.: "The Cyanide Process," by Dr. A. Scheidel, M.E., and "Notes on Gold Milling Practice in California," by E. B. Preston, M.E.

It is the intention of the Bureau to publish each year a "*Mineral Statistics Bulletin*," giving the yield and value of all the mineral products of the State for the preceding year. The addresses of all producers have been or are being obtained with this object in view. The only detailed statistics now available are those obtained by the U. S. Mint and the U. S. Geological Survey, but they are generally published many months after they are collected. The Bureau will endeavor to publish this bulletin as soon after the close of each year as it is possible to get returns from the mines. It will cover the statistics of all mineral substances worked in California.

It is intended also to issue special bulletins on Mine Drainage, Mine Ventilation, Mine Pumps, Methods of Quarrying and Preparing Slate for Market, Electricity for Power for Hoists, Mills, Drills, etc. The bulletins issued thus far in 1894 have met with marked favor, and are in such great demand that already a second edition of that on "Methods of Mine Timbering" is necessary.

It is suggested that it might be well to follow the precedent established by the U. S. Geological Survey, and charge all people *outside of the State* (except public institutions, such as libraries, colleges, etc.) for the publications of the Bureau. The demand for the reports, bulletins, maps, etc., is so great that the item of postage alone is considerable. A small charge for the publications would assist in defraying the expenses of the Bureau. People who do not contribute to the support of the State government can hardly expect its publications free, yet demands are constantly being made for our reports and bulletins from Nevada, Idaho, Utah, Montana, Oregon, and other mining sections, as well as from the Eastern States and foreign countries.

The edition of 10,000 copies of the Xth Report is exhausted, and as it is frequently referred to in this report, descriptions of mines, etc., mentioned therein, will be copied and mailed to those making application for such detailed information.

It is not generally known that packages of minerals not exceeding 20 lbs. in weight, may be sent to this Bureau *free* from any railroad office of Wells, Fargo & Co. within this State. By this means miners may send specimens of their ores for donation or examination; the former being duly classified, appropriately labeled with the names of the donors, and remaining on permanent exhibition in our museum. A special feature of the Bureau is the determination of minerals. This is done free of charge, *but no quantitative analyses nor assays are made.* In order to accommodate those who have confidence only in an official analysis or assay, I would recommend that the Legislature enact a law permitting the Bureau to make *check analyses and assays.* Those who desire them should send the substance to be analyzed to the Bureau, where it would be thoroughly intermixed and three samples taken—one to be kept in the Bureau, one to be analyzed or assayed in the Bureau, and the third to be sent to whatsoever chemist or assayer the party sending the substance may designate. The charge, therefore, should be double

that usually paid here—one half to go to the Bureau and one half to the private chemist or assayer.

The mineral exhibit at the recent Midwinter Fair in this city, arranged by a committee of the California Miners' Association, was in every way creditable. The Mining Bureau contributed seven cases containing every economic mineral found in the State, and I would have recommended that a much larger exhibit be made had we a fund to draw upon for the necessary expenses; but having the largest and finest mineral collection west of the Missouri River, in the very heart of the city, and *free to the public*, the State Board of Examiners would hardly consent to pay the State's money to maintain the State's property in an exhibition where an admission fee was charged under the foregoing conditions. The mine owners and counties of the State sent many and fine specimens of ores and minerals, so that the collection as a whole was well calculated to attract attention to the mining industry of California.

Forming an appendix to this report are the full texts of several laws which have been passed during the period covered by our twelfth report. These are the following:

(1) "An Act to provide for the establishment, maintenance, and support of a bureau, to be known as the State Mining Bureau, and for the appointment and duties of a Board of Trustees, to be known as the Board of Trustees of the State Mining Bureau, who shall have the direction, management, and control of said State Mining Bureau, and to provide for the appointment, duties, and compensation of a State Mineralogist, who shall perform the duties of his office under the control, direction, and supervision of the Board of Trustees of the State Mining Bureau," approved March 23, 1893. This is the new Organic Act under which the State Mining Bureau is now conducted.

(2) "An Act to establish a uniform system of mine-bell signals to be used in all mines operated in the State of California, and for the protection of miners," approved March 8, 1893.

(3) "An Act to amend an Act entitled 'An Act to establish a Civil Code,' approved March 21, 1872, by adding thereto two sections, to be known as Sections 1424 and 1425, being title nine, part four, division two, of said code, concerning the manner of conducting the business of hydraulic mining," approved March 24, 1893.

(4) "An Act to provide for the appointment, duties, and compensation of a Debris Commissioner, and to make an appropriation to be expended under his directions in the discharge of his duties as such Commissioner," approved March 24, 1893. Under the provisions of this Act, Mr. John F. Kidder, of Grass Valley, has been appointed Debris Commissioner.

(5) "An Act to create the California Debris Commission and regulate hydraulic mining in the State of California," approved March 3, 1894. This is the so-called "Caminetti law," reference to which has been previously made.

There is an almost constant demand upon the Bureau for copies of the United States mining laws, and had not this report been already sufficiently voluminous, with a prospect also that at its next session Congress may make important changes, they would have been prepared for publication.

An important mining suit between the Champion and Wyoming mines, Nevada County, has been decided in the United States District

Court, but as it has been appealed. it is deemed best to defer giving an abstract of the decision until the Supreme Court passes upon the questions involved.

I take pleasure in acknowledging the valuable coöperation of Governor H. H. Markham in all matters appertaining to this office. He has always been ready with cheerful advice and assistance, has personally inspected the Bureau and its workings, and shown great interest in its advancement and success.

I desire to express my thanks also to your Board for its hearty coöperation in the work of conducting the business affairs of the Bureau, and assistance in carrying out the various suggestions connected with the general work.

The daily presence and assistance of your President, Mr. J. Z. Davis. is very highly appreciated by the State Mineralogist and all the employés of the Bureau. No man could be more disinterestedly zealous in furthering the advancement of this institution. The active personal interest taken by him in all the details of its administration is of the highest value to the Bureau and the State. His accustomed generosity continues moreover, and the museum has been greatly enriched by his numerous and constantly added donations.

I am gratified to be able to say, also, that each and every one of the field assistants and office employés has displayed ability, diligence, and zeal in his duties, and to each I tender my thanks for their hearty coöperation in the work of the Bureau.

The members of the mining engineering profession, and many other friends of the Bureau throughout the State, deserve the thanks of the Trustees and Mineralogist for assistance rendered in various ways.

Respectfully submitted.

J. J. CRAWFORD,
State Mineralogist.

MINES AND MINING PRODUCTS OF CALIFORNIA.

ANTIMONY.

The only works in the United States for the production of metallic antimony from ores are in San Francisco. The ores are obtained both from California and Nevada, the latter State producing the major portion. The total output of metallic antimony in 1893 was 200 tons, valued at $36,000. This was from 400 tons of ore, of which the California production was 50 tons of 50 per cent ore.

INYO COUNTY.

Panamint Range.—Deposits of stibnite occur on the western slope of this range, 3 miles S. of Wild Rose Springs. They outcrop along the side of the mountains at an altitude of 5,000 to 6,000 feet. Eleven claims have been located on these veins, which extend E. and W. in a body of mica schist. The dip is S., but at a very small angle. The surface openings show the deposits to vary in thickness from a few inches to 5 ft. Not enough work has yet been done to demonstrate their real extent. In many places the stibnite is quite pure, in others it has with it a gangue of quartz. On some of the claims the oxide of antimony is in excess of the sulphide, and evidently has resulted from the oxidation of the latter. The main vein can be traced for a distance of over 4,000 ft. On the north side of Wild Rose Valley another vein, 18 in. in thickness, has been opened. There are probably 100 tons of ore on the various dumps. J. Danielson, C. Anthony et al., of Darwin, owners.

KERN COUNTY.

The antimony-bearing formations of Kern County have been worked on Erskine Creek, in the Sierra, and in the San Emidio Mountain, in the Coast Range.

Boushy Mines.—They are on Antimony Mountain, near the head of the San Emidio Cañon. See our Xth Report, p. 225. These mines have been worked intermittently since 1890, and ore has been reduced.

Erskine Creek.—There are several small mines on this creek which have yielded sulphide of antimony, and, in some of them, native antimony. See our XIth Report, p. 237. A few years ago a furnace was erected for the reduction of antimony ore, but in 1893 it was standing idle.

Grace Darling Mine.—This is near Erskine Creek, and was discovered at an early day, but was not worked until 1891. Ten tons of ore were shipped from this mine in 1893.

Padre Mine.—It was discovered in 1892. It is situated on the east side of Tail-hold Cañon, which leads into Pleyto Cañon. The lode appears to have the same general strike as that on which the Boushy

mines are situated. The workings consist of a 25 ft. long tunnel, which cuts a body of antimony-bearing matter 15 ft. in width. The wall rock is granitic. In 1893 there were about 3 tons of high-grade antimony ore (stibnite) on the dump. The mine is reached by a rough trail, but a road could be made without great difficulty to the Pleyto Ranch. Hauling from the Pleyto Ranch to Bakersfield costs from $4 to $5 per ton.

Standard Mine.—This is on the East Fork of Erskine Creek, at the contact of the slate and limestone formations. At this mine a pocket was taken out which yielded about 15 tons of high-grade ore (stibnite), which showed 60 per cent of metallic antimony by assay, and was sold in 1893 for $45 a ton f. o. b. the cars at Caliente, 40 miles distant. This price was not remunerative.

San Emidio Mines.—These mines are located in San Emidio Cañon, in the southern part of Kern County. The veins outcrop on the sides and over the summit of a rugged granite peak rising over 6,000 ft. It is almost perpendicular on its eastern side, where the position and character of the deposits are well shown. The ore appears in places over a vertical distance of 1,000 ft. or more. Where the ore is not found the line of the fissure is marked by a red stain and the decomposed condition of the granite. The deposits have a N.W. course and vertical dip. The ore appears as discontinuous, bunch-like bodies along a fissure system, occasionally reaching a thickness of 10 ft. On the summit of the mountain the ore bodies are not confined to a single fissure, but occur over an area 2,000 ft. wide. The property consists of five patented and four unpatented claims. The ore averages 40 per cent antimony. In places it is rich in silver, with the occasional appearance of iron and arsenical pyrites. A tunnel from the San Emidio Cañon 1,300 ft. long would cut the veins at a depth of 2,000 ft. At present the mines are reached only by a steep and narrow trail, down which all the ore has to be packed to the reduction works. Nothing but assessment work has been done for some time. See our VIIIth and Xth Reports, pp. 680 and 225.

Undeveloped Deposits.—In the mountains east of the San Emidio mines are a number of antimony deposits, as yet undeveloped. The deposits are also in granite and have a nearly E. course. The ore is found in places for a distance of 4 miles.

SAN BENITO COUNTY.

Ambrose Mine.—This mine is in the McLeod District, in the N.E. corner of the county. The ore occurs in the form of a somewhat bunchy vein, varying in width from a mere streak to 2 ft., and is inclosed in quartz trachyte. The walls proper are 5 ft. apart, with crushed trachyte between them. The antimony is found next to the hanging-wall seam and crystallized from that seam. Two tunnels have been run, one 365 ft. long and the other 320 ft. At present an upraise is being made to connect the two. The deposit is remarkable for the beautifully crystallized masses of which it is largely composed. In 1893, 10 tons of ore, which yielded 50 per cent of metallic antimony, were shipped from this mine. See our Xth Report, p. 517. Joseph Bishop, of Hollister, owner.

Appeal Mine.—At this mine a body of antimony-bearing silicious rock is exposed, which appears to be an extension of the ledge on which

the Shriver is situated. The owner states that 1½ tons of high-grade antimony ore (stibnite) were shipped from this mine in 1893.

Gleason Mine.—This mine was opened in 1893. It is in Sec. 6, T. 12 S., R. 7 E. A ledge of antimony-bearing silicious rock is here exposed, which has a width of more than 20 ft. The strike of the ledge is about N. 22° W. The workings consist of an open cut 20 ft. long and 12 ft. in depth. The owner states that 8 tons of high-grade ore (sulphide of antimony) were shipped from this mine in 1893.

Shriver's Mines.—This group of claims is situated in Sec. 31, T. 11 S., R. 7 E., and consists of the Shriver, Eureka, Star, and other claims.

Shriver Mine.—It is about 2 miles S.W. of the Ambrose Mine. The deposit occurs in a dark volcanic rock. The dip is 70° to the N.E. The vein is irregular, along a crushed zone. See our VIIIth and Xth Reports, pp. 485 and 516. G. Shriver, of Hollister, owner.

Eureka (Buckeye) Mine.—The principal workings on this claim are about a quarter of a mile S.E. from the Shriver. They consist of a tunnel about 100 ft. in length, from which short drifts lead off to the N.E. and S.W. The lode is a silicious antimony-bearing rock, similar to that seen in the Shriver.

Star Mine.—A ledge of silicious antimony-bearing rock is exposed on this claim. The owner states that he struck a good "prospect" of cinnabar while doing assessment work on this claim in 1893.

SAN LUIS OBISPO COUNTY.

San Simeon Creek.—No work has been done on the antimony deposit on the head of this creek for two years. Several tons of good ore were taken out, and then the work stopped. The deposit appears as a short, bunchy vein in sandstone of apparently Tertiary age. The vein has been opened for a distance of 40 ft., and shows a greatest width of 3 ft., thinning out toward either end. The quantity cannot be great unless it increases with depth. See our Xth Report, p. 579.

ARGENTIFEROUS GALENA.

INYO COUNTY.

Baltic Mine.—This mine is situated on the eastern slope of the mountain range in the northern part of the county. It has been worked much of the time for the past fifteen years. The vein is said to average 3 ft. wide. At present nothing is being done. L. P. Roberts, of Big Pine, owner.

Belmont Mines.—These are situated near the summit of the Inyo range, 3 miles S.E. of Cerro Gordo. Nothing has been done here recently, and the properties are for the most part abandoned. They were thoroughly described by Mr. Goodyear in our VIIIth Report, p. 252. W. S. Hunter, of Independence, owner.

Black Warrior, Fitz, and Antelope Mines.—These mines are situated on Lookout Hill, and belong to the same group of mines as those of the Modock Mining Company. They are developed by both tunnels and shafts. About 30 per cent of the value of the product of these mines is lead and 5 per cent gold. Frank Fitzgerald, of Modock, owner.

Defiance, Independence, Burnon, and other Mines.—These mines are situated 1 mile N. of Darwin, on Mt. Ophir. The Defiance is the most noted of this group and has been worked for many years. The Burnon and Independence have been idle for the past year. The ore is silver-bearing galena in the form of chamber deposits in a calciferous quartzite, which quartzite lies between limestone and a granitic rock. A rich body of ore has recently been struck in the Defiance. These mines were described in our VIIIth and Xth Reports, pp. 226 and 211. P. Reddy, Crocker Building, San Francisco, owner.

Lucky Jim and Christmas Gift Mines.—They are 3 miles N. of Darwin, on a continuation of the same mineral belt on which the Defiance Mine is situated. The Lucky Jim is now being reopened and the material left in the old stopes sorted and jigged. The ore is a silver-bearing galena. The mine was described in our VIIIth and Xth Reports, pp. 226 and 211. J. A. McKenzie, of Darwin, owner.

Modock Consolidated Mining Company's Mines.—They are as follows: Confidence, Lookout, Modock, Keys, and Hearst. They are situated on the eastern slope of the Argus range, 15 miles S.E. of Darwin. At present they are being worked under a lease. The deposits are chiefly silver-bearing galena with a little gold, the inclosing rock being limestone. The deposits are generally in chamber form, though sometimes approximating the form of veins. A tunnel 1,950 ft. long has been run to tap the deposits, the greatest depth reached below the surface being 1,150 ft. The best ore has been taken from this tunnel. It is said the ore carries 101 to 293 ozs. silver, 52 per cent lead, and less than ½ oz. gold per ton. Hornsilver and carbonates occur in limited extent. Lookout Hill, on which the mines are situated, seems fairly filled with chamber-like deposits of galena; many not showing on the surface. These mines were located in 1875, since which time it is said $1,900,000 has been taken out. Frank Fitzgerald, of Modock, lessee.

Sorba Mine.—It is 2 miles E. of Darwin. The vein runs E. and W., and is inclosed in limestone, and was discovered in the early days of mining in this section, but the present systematic development dates from the last few months. Three shafts, respectively, 30, 80, and 250 ft., have been sunk. The latter follows the ore body on the incline. The ore consists of galena, carrying silver, hornsilver, carbonates, and a decomposed ferruginous matter containing gold. The ore carries 90 to 200 ozs. silver, 36 to 60 per cent lead, $3 to $18 gold per ton. On the surface the vein dips northerly; in the bottom of the incline, easterly. The vein is traceable on the surface nearly the whole length of the claim. Its position bears no relation to the dip and strike of the country rock. Inyo Mining and Development Company, of Darwin, owners.

St. John and St. Arthur Mines.—They are situated on the S. side of Lookout Hill, in the section formerly known as the Minnietta. They lie 1,000 ft. lower than the mines of the Modock Consolidated Mining Company. The deposits are a continuation of those of that company, and are of the same character. The side of the mountain is very steep, and the developments consist almost wholly of tunnels. J. J. Gunn, of Modock, owner.

Union Mines.—They are near Cerro Gordo, and not far from the summit of the Inyo range, and are at present being worked under a lease. No underground work is going on; all that is being done consists in "sorting" and working over the old dumps. Described in our

VIIIth and Xth Reports, pp. 250 and 213. No new developments have been made since these reports. Thomas Boland, of Keeler, owner.

LOS ANGELES COUNTY.

Several veins of argentiferous lead ores are found on Santa Catalina Island, which have been worked from time to time since 1859. During 1893, mines near the isthmus yielded 30 tons of selected ore, which returned, at the Selby Smelting Works, over $100 per ton. The ore is usually high grade, but occurs in small shoots, and as no systematic development has ever been undertaken, the output has never been large.

Argentiferous lead ores occur on the south slope of the Sierra Madre range, 8 miles N. of Pasadena, in small quantity. Only superficial work has been expended upon them.

ORANGE COUNTY.

At several points between *Trabuco* and *Santiago* cañons, considerable prospecting has been done for lead and silver ores. The formation in which these ores occur is a heavily mineralized rock, which in its alteration and general appearance resembles felsite, or rhyolite. Decomposition has progressed so far that it is impossible to more than guess the original character of the rock. The sulphides of lead, zinc, and iron, with gold and silver, have infiltrated the fissures and formed accumulated veins. The baseness of these ores and the low price of silver render the mines almost valueless. These mines are similar to the Old Dominion Mine, in this county. Considerable money and work have been expended on the *Silverado Group*, but all of these properties are now idle.

Acme Mine.—This location is 7 miles W. of Elsinore, and adjoins the Old Dominion. The developments consist of an open cut on the vein, and a tunnel 100 ft. below the croppings, which had not yet, to all appearances, cut the vein. This region is full of mineral and justifies intelligent prospecting.

Old Dominion Mine.—It is 7 miles W. from Elsinore. The workings consist of several surface cuts, a shaft connected with a cross-cut tunnel, and some small stopes. The strike of the fissures is N.W. and the dip W. The surface ores are oxidized, but soon give way to a mass of intimately mixed, fine-grained sulphides of lead, iron, copper, and zinc. All these ores contain gold and silver, and in some places the grade is quite high. It would appear that by far the most practical way to handle ores of this grade and class would be to sack and ship them to the smelting works. The total cost of mining, transportation, and reduction should be less than the reported yield, and a profit should result.

SAN BERNARDINO COUNTY.

There are numerous veins and deposits of argentiferous lead ores (galena and carbonate) in the Silver Mountain District, which comprises that section lying E. and N.E. of Oro Grande, on the Mojave River. These deposits are scattered promiscuously over an area of 6 miles square. The deposits occur in limestone, or at contact of limestone and eruptive rocks, dikes, and intruded masses, which are numerous in the region. The geology is rather complex, owing to the folding and faulting

of the rocks, and the intrusion of the eruptive masses of the many mining locations in this district, some showing encouraging prospects. The following are the most prominent:

Carbonate Mine.—This is the largest mine in the district. See our XIth Report, p. 361. Since that report the shaft has been sunk 50 ft. additional, and a winze 30 ft. on the 150 ft. level. A large amount of ore is exposed in these workings, and indications are that the mine will make a good record of production as soon as a market for the ore is opened. The ore contains from 10 to 50 per cent lead, considerable iron and manganese oxide, lime, silica, gold, and silver, and is a very desirable ore for smelters. In the west or Gold shaft, some developments have been made, and the gold seam persistently followed, as small pockets of rich gold rock are occasionally found. Cross-cutting would perhaps result in the discovery of other veins, particularly on the foot-wall side.

Galoot Mine.—This claim is 5 miles E. of Oro Grande. It shows a shoot of lead and copper ore 200 ft. long. Several prospect holes on the vein have exposed some high-grade lead ore. It is one of the most promising claims of the district.

Harrison Mine.—It is 6 miles E. of Oro Grande. The vein varies from a few inches to 2 ft. of lead and zinc blende. The oxidized ore is said to contain upwards of $100 in gold per ton.

Galena, Lookout, Northern Cross, Santa Fe, and Unfortunate Sam Mines.—Each of these small claims shows small veins or bunches of lead ore. On some of them considerable work has been done, but the result is not encouraging.

The claims at *Galena Camp*, *North Camp*, and *West Camp*, 12 miles W. and N.W. of Oro Grande, show more or less lead and silver ore in small bunches; none are working at present.

ASPHALTUM AND BITUMINOUS ROCK.

California is the principal producer of asphaltum and allied bitumens in the United States. Deposits of asphalt of all the varieties are widely scattered over the United States, but are only worked to any extent in California, Utah, and Kentucky. Two deposits of rock asphalt are worked in this State: one in Kern and the other in Santa Barbara County. There is also one of "liquid asphalt" in the latter county, and in Kern County are numerous superficial deposits of asphaltum. Bituminous rock deposits are found and worked in many counties of California, and some years the product has reached 60,000 tons. Its use as a paving material is constantly on the increase, the bulk of the product coming from the counties of Santa Barbara, Santa Cruz, and San Luis Obispo.

KERN COUNTY.

The principal asphaltum-bearing formations are in the foothills of the Coast Range, on the western side of the San Joaquin Valley, and in localities known, respectively, as the *Buena Vista District* and the *Sunset Oil District*.

Buena Vista Oil and Asphaltum District.—The principal production of asphaltum in Kern County is in this district, which is distant about

30 miles N.W from the Sunset Oil District. The asphaltum industry in Kern County has been greatly stimulated by the extension of a branch line of the S. P. R. R. from Bakersfield to Asphalto, where a refinery, which is furnished with twenty-one kettles, has been erected by the Standard Asphalt Company to work its own claims and lands leased from the Buena Vista Oil Company and others.

The asphaltum deposits at Asphalto are found under two conditions: First, as superficial beds of impure asphaltum similar to those found in the Sunset Oil District. Secondly, as veins of high-grade asphaltum in the country rock. Of these deposits the veins of asphaltum are the most important, for although the superficial beds contain a large amount of crude asphaltum, only a small portion of it is sufficiently pure to pay for mining and refining by the methods now employed.

The asphaltum occurs in deposits with the same strike and dip as the inclosing rock, as well as in fissures that cross the course of the country rock, which appears to be of late Tertiary formation.

The refinery at Asphalto was completed March 1, 1893. The first run was made on 300 tons of crude asphaltum from the superficial asphaltum beds before described. In this run about 100 tons of refined asphaltum were produced. During 1893 the market price for refined asphaltum has averaged $25 a ton f. o. b. at Asphalto.

In the following table analyses (made by G. O. Simmons, of Sedalia, Mo.) of asphaltum from the Trinidad Pitch Lake are compared with analyses (made by Clifford Richardson, of Washington, D. C.) of asphaltum from the Buena Vista District, California:

	California. Sample H, From Mine.	California. Sample H, Refined.	Pitch Lake—Average.	Pitch Lake—Best.
Specific gravity	1.132	1.240	1.3857	1.3771
Softening temperature, Fahr.	180 degrees.	150 degrees.	190 degrees.	183 degrees.
Flowing	220 degrees.	180 degrees.	205 degrees.	198 degrees.
Inorganic matter	9.57 per ct.	9.77 per ct.	35.66 per ct.	35.48 per ct.
Bitumen soluble in CS_2	85.49 per ct.	90.16 per ct.	56.29 per ct.	57.47 per ct.
Bitumen soluble in ether	69.98 per ct.	86.45 per ct.	41.43 per ct.	41.59 per ct.
Percentage of total bitumen soluble in ether	81.85 per ct.	95.88 per ct.	73.60 per ct.	72.37 per ct.

The following tests of asphaltum were made by H. Stillman, Engineer of Tests to Motive Power and Machine Company at Sacramento (S. P. Co.):

Locality.	Ash.	Soluble.	Insoluble.
Trinidad	1.5 per ct.	46.30 per ct.	52.20 per ct.
Cuban	2.8 per ct.	44.25 per ct.	52.85 per ct.
Asphalto	6.5 per ct.	59.55 per ct.	33.95 per ct.

Combustion Tests.

Locality.	Volatile Hydrocarbon.	Fixed Carbon.	Ash.
Trinidad	75.15 per ct.	22.7 per ct.	0.15 per ct.
Cuban	70.20 per ct.	27.0 per ct.	2.80 per ct.
Asphalto	81.40 per ct.	12.1 per ct.	6.50 per ct.

Two samples of asphaltum from Asphalto were examined by W. B. Potter (of the St. Louis Sampling and Testing Works), and yielded 88.9 per cent from No. 1, and 85.32 per cent from No. 2.

Mr. W. E. Youle, manager of the Standard Asphalt Company, states that the crude material, as it is mined from the veins now being worked at Asphalto, averages 75 per cent of asphaltum.

Buena Vista Oil Company.—The property of this company consists of about 720 acres in addition to the territory leased from them by the Standard Asphalt Company. On their land are extensive superficial beds of impure asphaltum, and what appear to be outcropping veins of asphaltum have been found.

Sunset District.—Asphaltum is found in superficial beds: these beds appear to have been formed by the exudation of heavy petroleum, which, by partial oxidation and the evaporation of its most volatile constituents, becomes a pitch-like bitumen, varying from solid to viscous at ordinary temperatures. During 1892 this crude asphaltum was refined in works established by Messrs. Jewett & Blodget, at the Sunset Oil District, and about 1,200 tons of refined asphaltum were produced and shipped. The cost of producing refined asphaltum at the Sunset works was about $10 a ton, not including wear and tear of plant. The cost of transportation by wagon from the Sunset Oil Wells to Bakersfield was $6 a ton. The best quality of raw material in these asphaltum beds has been worked up, and the refining of crude asphaltum was discontinued at the Sunset Oil District when the S. P. R. R. extended its branch line to Asphalto, where there are deposits of asphaltum nearer to the railroad.

More details concerning the occurrence of asphaltum in this county will be found in Bulletin No. 3 of this Bureau, on "The Gas and Petroleum Yielding Formations of the Central Valley of California."

SANTA CRUZ COUNTY.

Baldwin Mine.—This is on the Baldwin ranch, 95 miles from Santa Cruz in a N.W. direction. During 1893, it produced 1,500 tons of bituminous rock. The rock taken from this mine is soft, and is said to contain 14 per cent of bitumen. Three men were employed in the mine and five in hauling the product.

Cowell Mine.—This is half a mile E. of the Walrath, and consists of 40 acres, having 20 ft. of bituminous rock in two strata similar to the Walrath. All of the mines of this group produce both hard and soft rock. The bituminous deposits appear to extend over a considerable area not opened at all. This area is not less than 8 square miles in extent, though probably not more than 3 square miles remain of the original strata, the balance having been eroded. Of that which remains a large amount—in fact, the greater portion—is commercially valueless, because of its low percentage in bitumen, but there are immense quantities of good material which will in time be mined. The usual method of mining is to bore holes 10 to 20 ft. in depth in series extending for some distance along the face. Two or three sticks of giant powder No. 2 are exploded in the bottom of each of these holes with water tamping. Into the chambers thus created large quantities of black powder and some giant are poured. The blasts are fired simultaneously by elec-

tricity. It is a common occurrence to break 500 tons at a single series of shots.

Enright Mine.—This is on the Enright ranch, 9 miles up the coast from Santa Cruz. During 1893 it produced 5,000 tons of bituminous sandrock, employing 5 men at the mine and 7 to 12 men in teaming. The mine was not in operation in March, 1894, but expected to be during the summer months. The rock from this mine is hard and contains 16 per cent bitumen. The strata in which the bitumen is found underlie 600 acres, but as far as developed only a portion of this is valuable, though more or less bitumen occurs in this region, covering several square miles. These deposits are exposed in the sides of the numerous cañons and ravines which have been eroded through the soft sediments. The rock of the several quarries has different densities, ranging from 14 to 22 cu. ft. to the ton, the average being about 15 cu. ft. In the Enright deposit fragments of large bones of an extinct animal, presumably mammoth, have been found from time to time. They are found saturated with bitumen. Vein-like masses of bitumen are not uncommon in these deposits. The veins occur in the form of accumulated or segregated deposits. Movements of the earth crust have resulted in fracturing the sandstones in which the bitumen occurs, and in some instances also the strata both above and below the deposits. Into these crevices the bituminous matter has oozed or distilled, forming veins of nearly pure bitumen. It is these occurrences which have given the impression that the bituminous matter came up from below. On the ranch close to the beach an oily matter is oozing from the rocks. A bore-hole was sunk on the plateau or marine terrace on the Sacroni place for oil, but none was developed.

Thurber Mine.—The mine lies immediately N. of and adjoining the Walrath, and employs 10 men in the mine and 20 teaming, etc.

Walrath Mines.—These are the largest operating in this county at present, though there are more extensive deposits adjacent. The Walrath group consists of 500 acres of land, of which about 75 acres is underlaid by the bituminous strata, of which there are two—the upper 15, and the lower 10 ft. in thickness. The average thickness of both is about 20 feet. The two layers are separated by a stratum of sandstone 8 to 10 ft. thick, which also contains bitumen, but in too small quantity to be valuable. If the deposits maintain their present thickness throughout, the output will be enormous. The mine employs 20 men in the mine and about 50 more in teaming.

MONTEREY COUNTY.

Undeveloped Deposits.—Bituminous rock occurs on the San Antonio River, 7 miles S.W. of Bradley Station. The deposit is quite extensive, but no work has been done on it. See our VIIth Report, p. 85.

A bituminous rock deposit, 11 miles E. of Kings City, was described in our XIth Report, p. 259.

SAN LUIS OBISPO COUNTY.

Bituminous Rock on the Pismo Grant.—See our Xth report, p. 574. No recent developments.

Jordan Mine.—This is situated in the Corral de Piedra, 7 miles S.E. of San Luis Obispo. The company owning this property has begun

shipping rock from a deposit north of the road leading from San Luis Obispo to Arroyo Grande. At the time of our visit (July, 1893) it was being crushed, sacked, and hauled to the new Pismo wharf.

Oregon Company's Mine.—This was formerly known as the California Bituminous Rock Company's Mine, and the deposit was described in our VIIth and Xth Reports, pp. 98 and 574. Here is an immense body of bituminous sandrock exposed in high and precipitous cliffs facing the N.E. The ore croppings are exposed for half a mile and have a thickness of 90 ft. in places. No work was being done at the time of our visit. The deposit is on the Corral de Piedra grant, 7 miles S.E. of San Luis Obispo. Oregon Bituminous Rock Company, of Portland, Or., owners.

San Luis Obispo Company's Mine is in the Corral de Piedra grant, 7 miles S.E. of San Luis Obispo. At the time of our visit no work was going on, owing to the small demand for paving material. See our VIIIth and Xth Reports, pp. 97 and 572.

Suey Creek.—A small deposit of asphaltum or brea is found on Suey Creek, 7 miles from Santa Maria. It is in the form of shallow seepages from the bituminous slate series, which has been much disturbed.

Tar Springs Asphalt Mine.—It is on Tar Spring Creek, 9 miles E. of the town of Arroyo Grande. Here numerous tar springs issue from the underlying bituminous slate series. They cover about 10 acres, much of which it is profitable to work. Some of the springs are very large and many barrels of pure tar have been taken from them. The tar is nearly 10 feet deep in places. The greater part of the material is mixed with rocks and soil, and is melted in huge vats from which the pure product is drawn off. Some solid asphaltum of excellent quality has been taken out. Tar together with water is constantly running into the holes which have been dug. Of the refined tar 800 barrels have been shipped. Tar Springs Asphalt Company, owners; C. F. Hunter, 111 South Broadway, Los Angeles, Secretary.

SANTA BARBARA COUNTY.

Gaviota Landing.—A deposit of bituminous rock occurs here exposed in the high cliffs. The formation is the bituminous slate series, which dips S. at a high angle. There is evidently a considerable body here, but the quality is rather poor. It occurs impregnating irregularly a sandstone stratum inclosed in the shales, and extends out underneath the ocean.

Harris Asphalt Mining Company.—This deposit is 4½ miles N. of Harris Station, on the Los Alamos grant. An excellent quality of asphaltum occurs here, being about 50 per cent. It is of sufficient hardness to break with a conchoidal fracture. The mine is developed by surface workings, which have uncovered a large body of material. It is overlaid by sand, while underneath is a bed of clay. There is no regular deposit; simply large bunches more or less connected. Hewitt & Haskins, of Oakland, owners.

About half a mile W. of the Harris Mine is a body of bituminous rock. A soft horizontally-bedded sandstone has been impregnated with bitumen. The beds outcrop over a considerable area, but never have been opened.

La Patera Mine.—This claim is on the Den ranch, near the ocean, 10 miles W. of Santa Barbara. The property was developed first by an

open cut following the course of the deposit, which is N.E. and S.W. The walls are formed of but slightly solidified clays, the stratification of which is very indistinct. In the cut the deposit is seen to consist of bunchy veins lying along an irregular fissure, from which stringers extend out into the country rock in various directions. This is one of the purest deposits of asphaltum examined, being 65 per cent bitumen. Four shafts have been sunk, being respectively 60, 65, 70, and 100 ft. deep, showing the asphaltum to be 3 to 12 ft. thick. Much heat is developed as the clay is exposed, so that the asphaltum partly liquefies and runs down the shaft in great masses. In one drift 27 ft. of asphaltum has been taken out, due to the swelling both from top and bottom. Other deposits appear along the ocean both E. and W. of the mine, and much is probably covered by the ocean. The asphaltum in all the deposits from Punta Gorda to and beyond the La Patera Mine has come from the same geological horizon. California Petroleum and Asphalt Company, owners; W. N. Cowles, President, Crocker Building, San Francisco.

Las Conchas Mine.—This is on the shore of the ocean near Carpenteria. The liquid tar found here has impregnated a clean beach sand of Quaternary age, overlying the bituminous shales and sandstones of the Miocene. It extends nearly half a mile along the beach, where the bitumen may be seen oozing out of the underlying rocks. The latter strike nearly E. and W., dipping at a high angle. At the point where most of the tar oozes out they are crushed and broken in a remarkable degree. This old beach deposit dips inland slightly, and near the bottom, especially toward the S., where the elevation is greater, large pebbles are mixed with the sand. There is evidently a basin-like depression extending east from Carpenteria partly inland, and the bituminous sands represent the southern and eastern borders. At some distance from the present shore the stratum of sand is nearly level. It extends at least three fourths of a mile inland, where it is often covered by 30 to 50 ft. of sand and soil. The company is working on land between the railroad and the ocean, but bitumen also crops out or oozes to the surface on many other parts of the ranch N. of the railroad. Near Mr. Higgins' house a drill struck the bituminous sand at 30 ft., and passed through it for 30 ft. The sand averages about 20 per cent asphaltum. The thickness of the beds where opened is 20 ft. One cavity was found 12 ft. in diameter, filled with pure liquid asphaltum. Near the ocean the covering of barren sand to be stripped is often less than 12 ft. This is the most remarkable deposit of its kind on the coast, the sand being so pure that it is separated from the asphaltum by the gravity process. The machine was invented for the particular kind of rock found here, and is said to work well; the refined product of liquid asphaltum contains 95 per cent of bitumen. At present none of the crude bituminous rock is shipped. The deposit is apparently inexhaustible and one of the most important in the State. This deposit was briefly described in our VIIth Report, p. 89. California Petroleum and Asphalt Company, owners; W. N. Cowles, President, Crocker Building, San Francisco.

Purissima Ranch.—About 2 miles N.E. of the old mission there are several deposits of asphaltum. On one a tunnel has been run, cutting a vein of unknown extent. These are on the same range as the deposits on the Rancho San Carlos de Jonata.

San Carlos de Jonata Ranch.—Large beds of asphaltum and bituminous rock occur on this ranch. The most important of these are in the center of the ranch. Two appear in vein form, 40 ft. thick, dipping into a hill from opposite directions, while the third forms a low knoll 300 ft. in diameter. All these deposits are dark in character and apparently of good quality. One of the vein-like deposits has been opened and a small amount shipped. The formation has the usual character of the Miocene in this section, consisting of chalky and banded shales. On the hill and in near conjunction with two of the deposits is another burnt chimney showing red colors and slag-like products. Portions of this rock are silicified, and contain in the cavities small masses of pure bitumen.

Santa Maria Mines.—The mines of the Santa Maria Asphalt Company are in the Pine Grove District, 10 miles S.E. of Santa Maria. Asphaltum and bituminous rock both occur here. The asphaltum is reported to be from 46 to 70 per cent. It outcrops over a considerable area along the N. slope of the hills bordering the Santa Maria Valley. The formation is a soft, sandy clay, probably of Pliocene age. The whole hillside seems to be cut up by irregular veins of asphaltum, varying in size from mere stringers to several feet in thickness. The developments are mainly in the form of open cuts. One tunnel has been run 40 ft., all the distance being through asphaltum. Masses 25 ft. across and of unknown length also occur. The deposit of bituminous sandrock belonging to this company lies to the W. of the asphaltum. It occurs covering an area one third of a mile long by 350 ft. wide. The deposit has never been opened, but is apparently very extensive. It shows a depth of 200 ft. as exposed on the side of the hill. Santa Maria Asphalt Company, of Santa Barbara, owners.

Tar and Tar Springs.—Tar is found seeping out of the bituminous slate series in the cañon of the Sisquoc, about in the center of the Sisquoc grant. The largest deposits are, however, to be seen along La Brea Creek, a tributary of the Sisquoc on the N. and emptying opposite the ranch house. At the mouth of this creek are heavy beds forming cliffs of a soft, friable sandrock thoroughly impregnated with bitumen over a considerable extent. It is so dried out on the surface that the quality could not be ascertained. For a distance of 2 miles up the creek there are many tar springs, both on the main creek and on its tributaries. The rock from which it exudes is a banded, silicious argillite, weathering light-colored. The dip is to the N.E. at varying angles. Deposits of apparently commercial value appear in several places. The tar is quite thick, and is generally accompanied by water more or less mineralized.

A deposit of thick tar appears in a cañon on the western end of the Tinaquaic grant and about a mile north of the road. The formation is a hard, light-colored slate, belonging to the Miocene. The tar oozes up through the debris in the bottom of the cañon, firmly cementing it in a solid mass. It appears on the surface for several hundred feet. A number of trenches have been dug showing the tar to be so mixed with the coarse rock material that it would be difficult to mine it profitably. Springs of considerable size issue from the trenches and are strongly mineralized.

Other Deposits.—Extensive asphaltum deposits occur in the range of hills lying between the Los Alamos and the Santa Ynez River. On the southern slope a vein-like deposit can be traced for miles in a direction

a little N. of W. They are in Sec. 17, T. 7 N., R. 32 E., in the quarter adjoining on the N.E. The highest and most prominent croppings have an elevation of 800 feet above those in the cañon, which seem to belong to the same vein. The deposit has a vertical position in argillaceous rocks, which are but slightly hardened and contain over 40 per cent of bitumen. The asphaltum is so hard that it softens but slightly in the sun. It has been opened by a cut and by a large, deep excavation, from which a few hundred tons have been shipped. The amount of material here is, from all that can be learned, apparently very great, and must become valuable when facilities for shipping are better.

The highest portion of the hills north of the asphaltum beds is formed of a hard, silicious rock, varying from different tints of yellow to bright red in color and often scoriaceous. The center of one of the occurrences, where the metamorphism has been greatest, has been opened by a shaft in search of quicksilver. The rock is porcelain-like in character, and gives a ringing sound when struck. These areas shade off on every side into the soft Tertiary rocks. The porous portions appear in the center of the greatest metamorphism, and closely resemble furnace slag, or a bituminous rock out of which the bitumen has been burned. Whether the intense heat which caused these effects preceded the deposit of the asphaltum, and was the cause of its formation, or occurred later, is not certain. It is certain, however, that they bear some relation to the asphaltum, for in quite a number of places in the county both were found together. There is no eruptive rock here as was supposed by Antisell, one of the geologists of the Pacific Railroad Survey.

Unopened Deposits.—At Point Arguello, near the mouth of the Arroyo Honda, and at other points toward Lompoc Landing, are deposits of bituminous matter of unknown value, never having been opened. These are interbedded in the bituminous shales at Point Arguello, while at the mouth of the Arroyo Honda they are associated with soft clays.

VENTURA COUNTY.

Punta Gorda Mine.—It is situated at Punta Gorda, in the extreme western part of the county. Work has been commenced in a cañon just above the railroad. The bituminous shales and clays strike about E. and W., dipping to the N. at a high angle. The asphaltum occurs in the form of bunch-like veins, well defined but very irregular. It has evidently been squeezed into an irregular fissure, which was formed without any reference to the stratification of the country rock. The veins, as far as developed, vary in thickness from a few inches to 4 ft. A tunnel had been run in 125 ft., and a shaft sunk at the end to a depth of 65 ft. The material taken out carries about 35 per cent bitumen. Punta Gorda Asphalt Mining and Paving Company, of Santa Barbara, owners.

Undeveloped Deposits.—An asphaltum deposit has recently been discovered on the western slope of the Rincon, about 2 miles from the Punta Gorda Mine. It is 1½ miles from the ocean, and has an elevation of 1,200 ft. It occurs impregnating a loose and crumbling sandrock and sandy clays of Miocene age. No developments had been made at the time of the visit, but the quantity exposed is considerable. A road is being graded so as to make it accessible.

BORAX.

Borax is produced in only two States of the Union—California and Nevada. Extensive deposits are found within the borders of these States which have been worked since 1873. For some years the bulk of the supply was from the Nevada side of the line, but for the past three years California has produced much the larger proportion. In 1892, out of the total yield of 12,538,196 pounds, the California yield was 11,050,495 pounds. In 1893, of a total of 8,699,000 pounds, California produced 7,499,562 pounds. The yield has been reduced of late, owing to decreased demand, which may be attributed to the prevailing depression in all branches of industry. Most of the product is obtained from the "borax marshes"; but in one instance, at Calico, San Bernardino County, where the borate bed has been tilted up with the inclosing sedimentaries, it is mined as a "vein" by means of shafts.

INYO COUNTY.

Salt Wells Borax Company.—The borax deposits of this company are situated in Salt Wells Valley, in the extreme southern portion of Inyo County. About 1,700 acres of borax land has been taken up. This is a recently organized company, and work is just being commenced. The deposits consist of borates of lime and soda. Salt Wells Borax Company, of Independence, owners.

LAKE COUNTY.

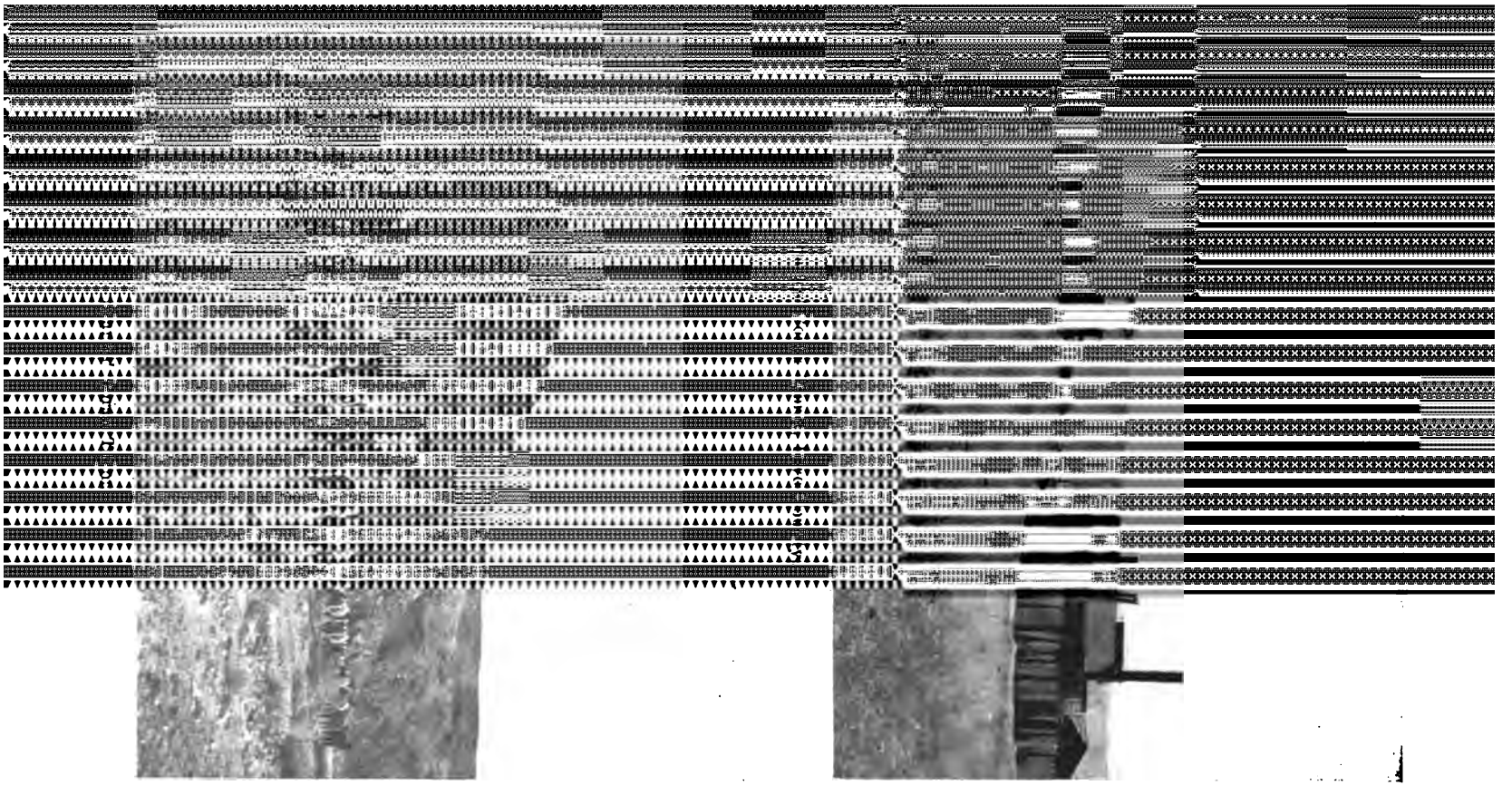
Borax Lake.—The extensive plant erected here has been idle for a number of years.

Another locality where borax has been found is at *Little Borax Lake*, near the shores of Clear Lake.

SAN BERNARDINO COUNTY.

The borax industry in the Calico region has received an impetus within the past two years, by the discovery of new deposits 6 miles N.E. of Daggett, of an entirely different nature from those of the Pacific Coast Borax Company. The new deposits are in the sedimentary strata which lie along the southern flanks of the Calico range at its eastern end. The intrusion of the eruptive rocks has folded, crushed, and displaced these sedimentary beds in a most perplexing manner. It is in the numerous cañons and gulches intersecting these upturned beds that the borate deposits are found. The new field extends from the immediate vicinity of Calico eastward a distance of 5 miles. These deposits present much the appearance of stratified masses of indurated mud; red, green, and gray in color. A white efflorescence occurs in places, giving the rocks a mottled appearance. Some of the rock is bluish-black, and resembles fine-grained, blue limestone. These beds have a generally southerly dip under the desert plain.

Since the above discovery other deposits of similar character have been found 5 miles N.W. of Daggett, on the opposite side of the (Calico) valley. These beds have a northerly dip. This fact suggests the possibility that these deposits are on the same strata. Should this be proven



to be a fact, the borate deposits will be found to underlie 60 square miles of territory.

These sedimentary deposits do not appear at the western end of the Calico range, and the probability is that if they ever existed at all, they lie buried beneath the later accumulation of debris from the adjacent hills.

Pacific Coast Borax Company's Mine is 5 miles E. of Calico. The deposit is described in our IIId, IVth, IXth, and XIth Reports, pp. 28, 91, 225, and 345. Since then the developments have been extensive and carried on over a considerable area, though chiefly confined to the same vein-like mass. These workings have now extended eastward a distance of 2 miles. The operations of this company are confined almost exclusively to the mining of "colemanite."

Stevens & Greer Mines are located along the southern side of the range at various points for a distance of 5 miles. The development on these various claims is small, consisting of open cuts and short drifts. The deposit in Garfield Cañon is exposed 40 ft. wide and 1,000 ft. long. The deposits farther east are quite irregular, much disturbed, and often folded in a synclinal fold, though these basins are found covering an acre or more of territory. The owners of these deposits have manufactured considerable quantities of borax and boracic acid. They pulverize the borate material and carefully add it to a boiling solution of sodium sulphate until brisk effervescence ceases, when the compound solution is allowed to cool and settle; the liquor is drawn off and the borax crystallized on wires by evaporation. An experiment was also made with the "mud-like" borate material. It was subjected to a low heat and then treated with sulphuric acid, which, uniting with the calcium, formed calcium sulphate, liberating the boracic acid; this being soluble, is dissolved out with water and crystallized from the solution by evaporation.

The Owens Mines are 5 miles N.W. of Daggett. They occur in sedimentary beds similar to those on the S. side of the Calico range, and have been exposed by the uplift of a mass of eruptive rock, the axis of which is nearly parallel with the Calico range. There is reason to believe that the upturned edges of this formation can be found in many places other than have thus far been discovered. A shaft has been sunk to a depth of 200 feet, vertically, cutting the strata at an angle of 70°. The deposit appears to be not less than 40 or 50 feet in thickness.

CHROMIC IRON.

For a number of years the only product of chromic iron ore in the United States has been from California. Its occurrence is noted in a number of counties, but it is now mainly produced in Alameda, Glenn, San Luis Obispo, Shasta, and Tehama. The industry of mining and shipping this substance is not very flourishing, owing to the facility with which it can be imported from Asia Minor. Our local product is only about one fourth the total consumption at Baltimore and Philadelphia. Ores producing less than 50 per cent cannot be handled and shipped to compete with those from the Mediterranean. Owing to the "pockety" nature of the deposits, it is difficult to determine anything about their extent except by actual work, and the deposits or pockets

are usually soon exhausted. The substance is generally mined on a royalty to the owner of the land where it occurs. The necessity of building roads to new deposits, when possibly only a few hundred tons may be taken out, prevents many known ones from being worked. Cost of transportation to the only markets, Baltimore and Philadelphia, by sea or rail, is the main reason which prevents California supplying the entire demand of the United States.

ALAMEDA COUNTY.

Douglas Mine.—It is in Cedar Mountain District, 12 miles S.E. of Livermore. In 1893 the product was about 50 tons of chromic iron, which is still on the dump. It is not as high grade as that of the Mendenhall Mine, and being a harder ore, will require crushing and concentrating to materially raise the grade. D. Mendenhall, of Livermore, owner.

Mendenhall Mine.—This is on the S.W. side of Cedar Mountain, 13 miles S.E. of Livermore. The mine produced in 1893 about 55 tons of high-grade ore, and there now lies sacked on the dump several hundred tons of ore, most of which is soft and has been mixed in mining with a great amount of waste. The soft, friable character of the ore, however, will render it an easy matter to wash it. Simply raking the ore in a puddling-box similar to that used by placer miners, and placing two or three lengths of sluice-boxes, provided with riffles, below, should result in raising this ore to an average of at least 50 per cent, and may do even better. The deposits are exceedingly variable in thickness and in dip. The ore bodies appear to lie in rolls and to occupy portions of the serpentine that are much crushed and broken. Some of the ore has a structure similar to decomposing serpentine, and appears to be a replacement of the serpentine itself by chromic iron. A. Mendenhall, of Livermore, owner.

DEL NORTE COUNTY.

Tyson Mine.—See our Xth Report, p. 169. No shipments are made at present, the demand being small. Tyson Mining Company, of Baltimore, Md., owners.

GLENN COUNTY.

Whitlock & Oakes Mine.—It is situated on a ridge of serpentine which rises to an altitude of about 3,000 ft., and forms the W. side of Milsap Valley. It is reached by a steep mountain road 3 miles in length from the mine to the Newville and Fruto county road. The workings consist of an open cut about 70 ft. long and 30 ft. deep, and a chamber about 20 ft. wide and 50 ft. in length. The deposit shows a mass of chrome more than 10 ft. in thickness, which in places is somewhat mixed with serpentine. During 1893 the mine was worked on a royalty, 15 men being employed; 3,319 tons of chromic iron were shipped. J. R. Whitlock, of Paskenta, Tehama County, and F. Oakes, of Newville, Glenn County, owners.

MARIN COUNTY.

On the *Mailliard Ranch*, 7½ miles W. of San Rafael, are several small deposits of chromic iron, none of which have been opened. As usual these bunch-like masses of ore occur in serpentine, and are very irregular. Analyses determined the ore to contain over 50 per cent chromium sesquioxide. A. Mailliard, of San Rafael, owner.

NAPA COUNTY.

Adjacent to the Snowflake Mine is an outcrop of chromic iron of good grade.

SAN LUIS OBISPO COUNTY.

Pick and Shovel Mine.—This mine is located 4 miles N. of San Luis Obispo, and about half way to the summit on the western slope of the Santa Lucia range. Work has been carried on here irregularly for seventeen years. There are 2,500 ft. of tunnel; the longest is 900 ft. The chromite occurs in bunches and stringers in a crushed zone. One bunch of 1,000 tons has been taken out. The chromite is found impregnating the serpentine as well as in almost pure masses. The bunches and connecting stringers are arranged in such an exceedingly irregular manner that no rule can be laid down for tracing the ore bodies.

The manner of occurrence of chrome ores is perhaps better shown here than in any other mine on the Pacific Coast, on account of the extensive workings. The fact that the chromite is confined to this crushed zone, and the serpentine gangue more or less silicified in places, seems to indicate a manner of deposition for this mineral similar to that of quicksilver. The chromite would thus not be an original constituent of the serpentine in the form or position in which it is found, but because of its invariable association with serpentine it was undoubtedly an original constituent in some form, perhaps disseminated through the mass and afterwards collected by means of mineral solutions. See our Xth Report, p. 583.

San Carpojoro Creek and the Arroyo La Cruz.—On the divide between them chromite is found. It is reported to be one of the largest deposits ever found in the county. It is almost inaccessible, and owing to the great expense of constructing a wagon road, has never been opened.

San Luis Obispo Deposits.—The chromite deposits 4 miles W. of San Luis Obispo have been worked to a small extent the past year, and something less than 100 tons taken out. No large bodies seem to have been found recently in the serpentine, but the greater portion was obtained from the gulches and hill slopes below the mines, by collecting the surface debris and sluicing it. The chromite appears disseminated through the serpentine in small stringers and bunches which can hardly pay for working. See our Xth report, p. 583.

SANTA BARBARA COUNTY.

A few tons of chromic iron have been mined 10 miles N. of Santa Ynez, but it is so far to market that it is not available.

SANTA CLARA COUNTY.

Hahn's Ranch.—There is a deposit of chromic iron of limited extent here. Some years ago a small prospect hole was sunk on it, but since that time nothing has been done.

SIERRA COUNTY.

Brandy City.—Chromic iron, in small quantities, is found here on Sec. 1, T. 19 N., R. 8 E., but is not being mined.

SONOMA COUNTY.

Sonoma Switch.—Several large detached bodies of chromic iron are to be found half a mile from this station, with some little prospect work expended on them.

TEHAMA COUNTY.

Tehama Consolidated Chrome Deposit Company.—The chrome deposits which are being worked by this company are situated on the North Fork of Elder Creek, and in Sec. 16, T. 25 N., R. 7 W., M. D. M. In this section chrome ore is exposed in five or six different places. The principal development consists of an open cut, where a body of ore more than 20 ft. in thickness is exposed. The wall rock is serpentine. During 1893, 3,200 long tons of ore were shipped from this mine; and in August, 1894, a new contract was being executed, which called for 1,500 long tons of chrome to be delivered f. o. b. at Red Bluff for $9 a ton. Twenty men are employed. See also our Xth Report, p. 692. Tehama Consolidated Chrome Company, of Red Bluff, owners.

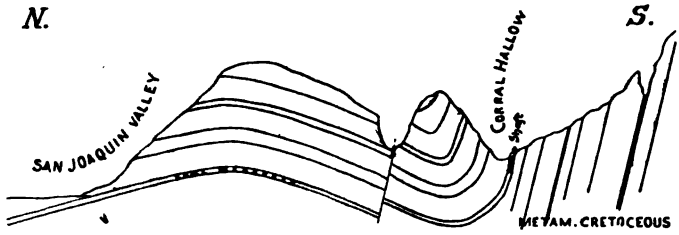
COAL.

The coal product of California comes from the counties of Amador, Contra Costa, Fresno, Monterey, Riverside, and San Diego. The largest yield is from the mines of Amador and Contra Costa, the latter being first in importance. The entire product of the State is now only about 75,000 tons per annum, an annual decrease of output being shown since 1889. The coals of the State are generally of an inferior character as compared with those imported. About 1,500,000 tons of coal are consumed in California yearly. About one third of this comes from British Columbia; one third from England and Wales; and the rest is from the East, Japan, Scotland, Oregon, Washington, and the local mines. With such a large domestic consumption, and so small a local output, the importance of exploiting and developing known coal "prospects" is apparent to any one. There are many places in the State where coal is known to exist, but where very little if any work has been done. The latest field of investigation is in Mendocino and Humboldt counties, which is more fully referred to further on in this chapter. Every encouragement should be given toward the development of this and other localities where there are indications that coal may be found. An interesting table of analyses may be found at the end of this chapter.

ALAMEDA COUNTY.

Corral Hollow Coal Field.—Considerable prospecting for coal has been done since 1862 in Corral Hollow Cañon and on Richard Creek, in the east end of Livermore Valley, and several thousand tons of good coal have been taken out and sold in the vicinity. The last description was published in our Xth Report, p. 91. At that time the rather shallow mines which had produced the coal had been closed down, being rendered worthless by excessive faulting. Since then all the mines on the Livermore side of the hill have been shut down for the same reason.

The coal measures in Corral Hollow are similar to those of Mt. Diablo, and are probably a continuation of that field; at least they belong to the same geological age. They contain three fair-sized veins of coal, with a number of thin seams and irregular streaks between. They are bedded on a white or reddish-white sand, which in places coheres enough to be called a sandstone. Between the veins lie a bluish clay, interspersed with seams of sand. The upper stratum is blue clay about 75 ft. thick.



PROBABLE STRATIFICATION OF COAL MEASURES IN CORRAL HOLLOW.

The whole coal formation measures perhaps 200 ft., and is covered up by a bed of soft-gray and bluish-gray sandstone 800 to 1,000 ft. in thickness. The lower stratum of this sandstone contains limonite in nodules and concretions, and the upper, fossil wood and oyster shells.

The only attempt at mining in this neighborhood at present is some prospecting by Mr. Treadwell. Where the wagon road from Livermore enters Corral Hollow Cañon, a tunnel is run on a course N. 36° W. with a view of striking the coal several thousand feet E. and N. of the old workings in Richard Creek, and at a considerable depth underground. Entrance to the mine and information of every kind was refused, but to judge from the size of the dump there must be a mile or more of drifts. The tunnel has a double track and seems to be well timbered. There is an air compressor and a fan, and an electrical plant, indicating an underground hoister.

Going down Corral Hollow from the tunnel the course of the creek is N. 75° E. for about 5 miles, the coal measures crossing it at a small angle, the average strike of the veins being N. 80° E. Below the tunnel 2½ miles, the same party has opened a shaft or incline on the S. side of the creek. There is a boarding-house, a shaft-house, and hoisting-plant. The "opening" is at the base of the hill, and about 15 ft. above the creek. Between the tunnel and the shaft lie the old workings, and some of them are still open. They illustrate how very much the strata have been twisted and broken. In the first drift entered the dip was 45° N.; at

the next one, only a short distance beyond, it was nearly 34° W. About a mile below a small gulch comes in from the S., and in it metamorphic sandstone and limestone outcrop, standing nearly perpendicular. Opposite the shaft the strata dip at a high angle to the N., and seem to lie as illustrated in the sketch on page 39.

The coal measures no doubt continue down the creek for several miles, but as the hills are covered with soil no exposures were noted. The bottom ledges of the gray sandstone will be a sure guide to the prospector. On the W. side of the divide, on Richard Creek, the gray sandstone overlying the coal is about 500 ft. thick. The hills become lower as we go W., the strata dipping to the N.W., until the coal, and even the sandstone, disappears below the level of Livermore Valley. There is every evidence on the surface that the coal measures have been subjected to repeated disturbances, and heavy faulting and crushing of the veins may be expected underground. The sand strata, wherever they exist as a roof in contact with the coal, render mining a most difficult operation. It is to be hoped that the long tunnel has struck ground not so much disturbed, so as to reimburse the owners for the great sums of money expended. The quality of the coal is similar in all respects to that of Mt. Diablo. It has a bright black color, is brittle, and crumbles readily on exposure to the air. At the tunnel two varieties are brought to the surface. The one said to come from the lower vein is very fragile, and contains an excessive amount of gypsum and pyrite. The other, supposed to come from the middle vein, looks much better; it is harder and contains less impurities. The coal from the lower workings (the shaft) is nearly of the same quality as the best from the tunnel. At this place is another variety, probably coming from another vein. It is tough, does not crumble, and has a dull, brown-black color. It is highly bituminous and burns readily with a long flame when heated. It is an excellent gas material, and may be called a cannel coal.

AMADOR COUNTY.

Ione Coal Field.—In the vicinity of Ione, some 36 miles S.E. of Sacramento, a heavy bed of coal has been worked to a small extent for a number of years. Behind the first ridge of the lowest foothills of the Sierra a series of lakes existed in ancient times, in which depressions the coal was formed. These extended from a short distance south of the Cosumnes River in the north to Jackson Creek in the south, and possibly farther. The formation consists of light-colored clays interstratified near the surface with carbonaceous matter and sand. It belongs to the Tertiary age, and lies non-conformably upon the Cretaceous rock below. The surrounding hills are Cretaceous sandstones capped with lava or conglomerates.

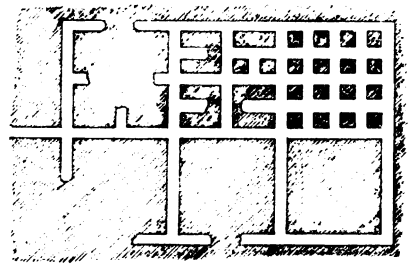
The coal is a brown coal. When taken out it is dull black, changing to brown and yellow-brown as it dries. It is soft and easily cut with the knife, and contains a large amount of *ionite* (a light, very fragile, dirty-yellow, earthy-looking hydrocarbon, found exclusively in this field), and also *gilsonite* and *rosin*. It carries a great deal of water as it leaves the mine, and in that state bears handling well, but as it dries it cracks and crumbles, for which reason it is shipped as wet as possible. It is used to a small extent for house coal in the vicinity, and is shipped to Sacramento, Stockton, and other points.

Used under the boiler it must be fed in frequently, in thin layers, and must have plenty of air. Furnaces especially constructed are used in Sacramento. If the fireman has once learned to handle the coal it makes a satisfactory and cheap fire.

To make this field to yield its full value some means should be found to utilize the coal on the spot. A gas plant may be erected and gas piped to Stockton or Sacramento, where it would be used in preference to any kind of coal; and as there is fuel, sand, and clay of excellent quality in abundance, a large pottery might be started, in which all kinds of chinaware could be manufactured. The increased demand for coal produced by such enterprises would reduce the cost of mining by rendering a systematic and economic way of mining feasible.

There are only two mines in operation—Mine No. 3 of the Ione Coal and Iron Company, and that of the Sacramento and Ione Coal Company. Both were described in detail in our VIIIth and XIth Reports, pp. 110 and 147.

Ione Coal and Iron Company's Mine No. 3.—The coal here is mined through tunnels only. From the base of the hoisting slope a gangway is driven as far as it is desired to work the coal through that slope, then tunnels are run right and left, 6 ft. wide and 50 to 60 ft. long, with a pillar left between 50 ft. thick. The short tunnels are next connected at their further end, so that now a pillar stands clear 50 ft. square. The next step is to divide this pillar by a tunnel 6 ft. wide in one direction and afterwards in another direction, leaving four pillars 22 ft. square; these are again cut crosswise, until finally sixteen pillars remain, each 8 ft. square. Two fifths of the coal in the whole area is left in the mine as pillars and probably another half fifth as roof.



MANNER OF MINING COAL IN MINE NO. 3.

Occasionally the clay above the coal is replaced by sand charged with water, and whenever that occurs a cave results, filling the workings for several hundred feet in every direction with quicksand. The coal dips slightly toward the center of the basin, and averages about 9 ft. in thickness throughout the mine. The quality varies somewhat, some streaks being brighter than others, although in mining it will be impracticable to keep them apart. The vein is made up as follows:

White clay above.		
Coal, Sample No. 4—left as roof	2′	
Gray shale		4″
Coal, Sample No. 3	2′	3″
White clay		3″
Coal, Sample No. 2	3′	4″
Coal, Sample No. 1		10″
Clay in bottom.		

The seam of white clay varies greatly in thickness, measuring in one place more than a foot, although the coal at that point was about as thick as elsewhere. Several faults, the largest of which is 2 ft., were noticed.

Lancha Plana Coal Field.—This deposit is 10 miles S. of Ione, and is considerably older geologically than that at Ione. The Murray and the Orr mines are the only openings.

The coal is a brown coal, which when taken out is black, and resembles the Ione coal; when dry it crumbles, changing to a light brown, with small black particles and thin seams of clay and other impurities showing in the mass. It contains a great deal of ash, but as nearly half of its weight can be driven off by heat, it may be considered a good gas coal. The exploration of this coal field has been very limited; only a few openings have been made, and they are close together. How far it extends, or whether it crosses the Mokelumne River into Calaveras County, is not known, as no shafts or borings of sufficient depth came under the observation of the Bureau to determine.

Murray Mine.—This mine has been idle since it was described in our VIIIth Report, p. 109. The workings are caved or are full of water.

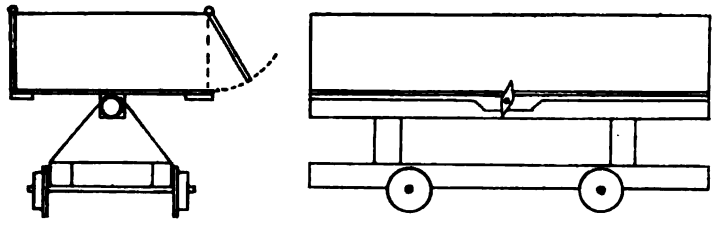
Orr Mine.—This is in China Gulch, 1½ miles S. from the Mokelumne River, and 2½ miles E. of Lancha Plana. China Gulch is a small valley, varying in width from 500 to 1,500 ft. Some of the land is under cultivation, and fruit of all kinds seems to do well. The surrounding hills are made up of white and yellow Cretaceous sandstones, unaltered and little disturbed. They dip slightly to the S. The two-compartment shaft, 104 ft. deep, is sunk on the slope of the hill some 30 ft. above the creek and is newly timbered. Hoisting is done by direct horse power. At the bottom of the shaft a short tunnel starts off in a northerly direction, and from it all the coal sold is taken. The vein, which is 4 ft. thick, lies practically level. There is no water in the mine. Below the coal lies blue clay and above it a very soft white sandstone. But two men are at work, and they only occasionally. Little or no attempt has been made to introduce the coal in the surrounding villages. Oak fire wood can be had at a nominal figure, and is preferred therefore by the people. Almost the only demand for the coal at present is at a steam plant in a gravel mine a few miles down the river.

Sacramento and Ione Coal Company's Mine.—The coal lies very near the surface, and is brought to daylight through an incline having a very easy slope, showing the following section:

Sand and sandy soil at the surface	8′	
White clay	4′	
Brown carbonaceous matter		7″
White clay	2′	8″
Fragile and poor coal, with gypsum	2′	
White clay		4″
Coal	1′	4″
White clay		1″
Coal	8′	
White clay in bottom.		

Tunnels are driven at the bottom of the slope in every direction, and from them the coal is mined by opening short rooms, 6 by 20 ft., on either side, and robbing the pillars afterwards. The lowest white clay seam shows throughout the mine immediately below the roof. It comes down with the coal in mining, and must be picked out. The next streak of coal, which makes a very good roof, is left for that purpose, little timbering being required. The rails used are T rails of good weight; the cars are arranged to dump at the side, and stand somewhat higher than the common end dumper. They measure 6 ft. 3 in. by 3 ft.

by 1 ft. 3 in. inside, and are made of pine. Mr. Muir, the Superintendent, says that the ground owned by the company is nearly mined out, and that he expects to take out the rest by January, 1894.



SIDE DUMPING CARS
USED IN THE MINE OF THE SACRAMENTO AND IONE COAL COMPANY.

Another mine was opened half a mile N. of Carbondale, and hoisting machinery and buildings were erected. At a depth of 100 ft., 18 ft. of good coal was struck, it is said. The shaft is 6 by 12 ft. and is well timbered. For some reason, not learned, no coal was ever taken out. The mine lies idle and water stands in the shaft.

About 2½ miles N. of Carbondale another opening was made by Mr. Newman, of Ione, but nothing has been done there since it was described in our XIth Report, p. 148.

CONTRA COSTA COUNTY.

Mount Diablo Coal Field.—A series of mines and croppings are known under this name, which encircle Mount Diablo with a radius varying in length from 4 to 10 miles. They lie on the N.E., N., and N.W. sides of the mountain. The geological formation belongs to the Upper Cretaceous or Lower Tertiary, and the strata dip in every instance away from the center of eruption at Mount Diablo. The dip ranges from 16° in the Brentwood Mine to 50° in the San Francisco Mine. As far as the field has been explored the strata are faulted and broken considerably. Near a fault the coal is always crushed and worthless and sometimes absent altogether. Below, as well as above the coal measures, lie sandstones of great thickness and of white, yellow, or reddish color. The strata immediately above the coal measures generally contain *limonite*.

The coal belongs to the lignites. It has a bright, black luster, is brittle, and crumbles readily to small fragments and dust on exposure to the air.

The coal measures vary in thickness from 350 to 400 ft., and contain three marketable veins of coal. The upper one, known as the *Clark vein*, lies immediately below the sandstone, except where occasionally some inches of clay slate intervene. The coal is bright, of good quality, and remarkably free from slate and bone. This vein has been a favorite in the different camps, and nearly all of it has been mined to a level where water begins to be troublesome. The next important vein, called the *Little vein*, extends through the whole field like the former, but is of

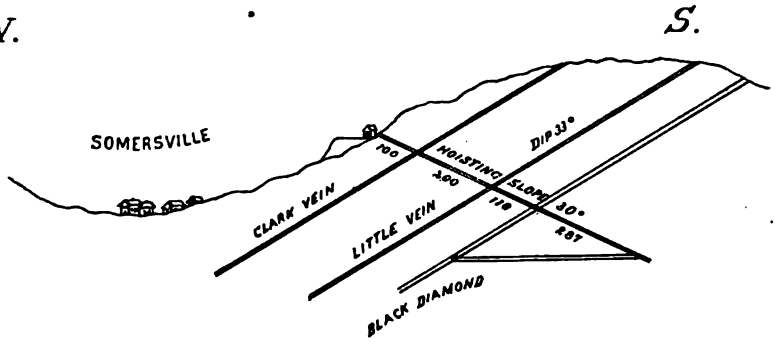
very irregular thickness. In some of the workings it shows a mere seam, while elsewhere it becomes a workable vein of 18 to 24 in. thick. It is more expensive to mine than the Clark vein, as it does not lie in contact with the sandstone, but has a stratum of bone or clay shale 2 ft. thick below as well as on top. The bone swells when exposed to air, and makes a troublesome, if not dangerous, roof and footing. The coal is bright and nearly as clean as that of the Clark vein.

The *Black Diamond vein*, which comes next in order, is generally the thickest of the series, averaging 3½ ft., but, like the other veins, it varies greatly, sometimes swelling to nearly 5 ft., and half a mile farther pinching down to 24 in., or even 18 in. It is the most expensive vein to mine, as there is bone 4 to 6 ft. thick above and below. The timbers must be placed very close together, and even then it is merely a question of time when they are crushed by the swelling of the bone. This coal is not nearly as pure or bright as that of the Clark vein. An inch or more of clay or slate is generally found about the middle of the vein. Between these three larger veins are a number of veins of carbonaceous matter containing coal seams a foot or less thick. The principal one of these is called the Belshaw, the Bogus, or the Floyd vein. In isolated patches it has been large enough to work, but as a rule it does not pay to extract the coal. The most easterly point at which the vein has been explored lies in Sec. 27, T. 1 N., R. 2 E., at the Brentwood Mine. The veins here proved to be large and the quality fair, but no work has been done on them since they were described in our VIIth Report, p. 145.

Central Mine.—See Stewart's.

Empire and Hartley Mines.—Farther W. some little work was done in Secs. 16, 18, and 7. The coal found here was dirty and crushed by faults, and the prospectors soon became discouraged and quit. In the next township toward the W.—T. 1 N., R. 1 E.—we find the Empire and West Hartley mines, both in Sec. 12. These have furnished considerable coal, but for the present are shut down. In both the coal has been mined to a level about 400 ft. below the surface. See our VIIth Report, p. 142.

Somersville Mines.—The next mines along the croppings of the coal vein are in Section 4 in and around the village of Somersville. They are the *Pittsburg*, *Union*, *Manhattan*, *Eureka*, and others. See our VIIth Report, pp. 117–140. They are all abandoned. With the exception of a small patch in the ground of the Pittsburg Company, and another one in the old Manhattan ground, the coal has been extracted down to where water interferes seriously. This point, called water level in the camp, lies about 350 ft. above the San Joaquin River. The only mine taking out coal lies in the ground of the Pittsburg Company, in a narrow ravine S. of the village. The opening is known as *Davis slope*. In the early part of 1892 work was begun in the bottom of the gulch, and this slope was driven 705 ft. on an angle of 30° in a southerly direction. The Clark vein was struck 100 ft., the Little vein 300 ft., and the Black Diamond 418 ft. from the mouth of the slope. Gangways were run on all three of the veins and the coal taken out nearly to the surface. The Clark and the Little veins were of nearly uniform thickness throughout, the former being 3 and the latter 2 ft.; both contained excellent coal. The Black Diamond was 3 ft. thick at the east end of the gangways, and 3½ ft. at the west; the coal was fair. When all the coal was mined on



Underground Working of Davis Slope.

these levels a tunnel was run from a point 680 ft. down the slope to cut the veins again at that level; this left a sump in the bottom of the slope 25 ft. deep. The tunnel strikes the Black Diamond vein 340 ft. from the base of the slope. A gangway 600 ft. was run westerly along the vein. Many faults were encountered and the gangway had to swing first this way then that, to keep the vein at the proper elevation above the rails. The coal in many places is crushed and worthless; in one instance this is the case for a length of 300 ft. The coal, where it is solid, is of good quality, and shows a thickness of 3 to 3½ ft. The dip ranges from 28° to 33° to the N. No work of any kind has been done on this level on the east side of the slope or on any of the other veins.

The slope is about 8 by 6 ft. in the clear and is not timbered, except where the old upper gangways are closed or where it crosses the smaller veins. The mine makes about 20 cu. ft. of water per hour, which is hoisted in tanks. Mules are used in the gangways and tunnel to move the cars to and from the slope. The hoisting engine has a cylinder 12 by 24 in., and a ⅝ in. wire rope is used on a 6 ft. drum. All the water used in the boilers is hauled by rail from the San Joaquin River. There are 9 miners employed whenever there is any demand for coal. The total shipments for the first four months in 1893 were only 3,000 tons. Ventilation is had by an upraise from the workings to an old tunnel, and thence up to the surface. A fire is kept burning in the tunnel where the air shaft crosses it, to make a draft. The tunnel just mentioned runs into the hills in nearly the same direction as the slope; its mouth is 300 ft. to the S.W. of the engine-house; it is 800 ft. long, and as it cuts all the veins, a section was measured, as follows:

Starting at the Clark vein, which crops out on the face of the cliff outside the tunnel—

Yellow sandstone, to mouth of tunnel			78′
Yellow sandstone			17′
Good coal			1′ 3″
Grayish sandstone			130′
Good coal	Little vein		3′
Black slate	Little vein		1′ 6″
White sandstone			8′
Bone			3′
Dirty white sandstone			56′
Black slate and clay			30′
White sandstone			46′

Black slate			6	
Yellow soft sandstone			90	
Thin seams of slate, bone, and clay			30	
White sandstone			80	
Good coal			1'	
Black slate			2'	
Gray sandstone with thin seams of clay, slate, and bone			67'	
Coal	Bogus vein; doubled up by a fault		2'	3'
A fault			12'	
Black shale			4'	6'
Dirty coal			3'	6'
Dirty white sandstone with seams of shale			96'	
Black slate				9'
Yellow sandstone			91'	
Bone	Black Diamond vein		6'	
Coal			4'	6'
Bone			6'	
Sandstone at face.				

Star Mine.—The Star Mine is in Sec. 11, and as this mine is one of the few producing coal at present, a description is herewith given of its underground workings.

An incline was sunk in a S.W. direction on a slope of 28° to a depth of 430 ft., cutting the veins at an angle of about 50°. When the Clark vein was struck it proved too thin to work; the Little vein, however, showed good coal of fair thickness. It was crossed at a depth of about 200 ft. Gangways were driven on the vein at this place, both E. and W., 850 and 700 ft., respectively, and the coal extracted between the gangway and the surface. These workings are now closed. At the base of the incline water was encountered, and as the Black Diamond vein has not been crossed, and as it was not desirable to go any deeper, a sump 30 ft. deep was left at the bottom of the incline, and a tunnel driven in the same direction as the incline. It struck the Black Diamond vein at a distance of 112 ft. The coal, however, contained so much bone and slate that it was worthless. Altogether the vein looked so different from its usual appearance that doubts arose whether it really was that vein or another, and to decide the question the tunnel was continued 100 ft. farther. No more coal was found and the work ceased. On the same level another tunnel was run, in nearly the opposite direction. It lies partly under the incline, and is nearly 400 ft. long to where it strikes the Little vein, and at its end two gangways are driven on that vein. The one to the W. is about 720 ft. long, and as its end lies in a large fault of unknown thickness, it is not intended to extend it. The coal is nearly all mined from this gangway, and it is expected that by the end of May the last of it will be cleaned out. The lift, the distance between this gangway and the one above, measured along the coal is 192 ft. The gangway to the E. is about 700 ft. long, and will be extended from time to time as new ground is needed, or until it strikes the old workings of the West Hartley, whose lowest gangway is about on this level, and probably 100 ft. from the present face. Should this connection be made it will create ventilation in both mines. As mentioned above, the Little vein is the only one mined here at present, and the coal is clean and bright. Near the E. end of the claim it is 20 in., and at the W. end 30 in. thick. The dip is from 20° to 24° N., 10° W. The white sandstone roof sometimes rests directly on the coal. From 1 to 16 in. of bone and slate generally, however, intervene. The bottom is a nearly uniform bed of blue slate 4 ft. thick, with white sandstone below. It is not intended to deepen the slope when the coal on this level is worked out, as it would

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MINING COAL

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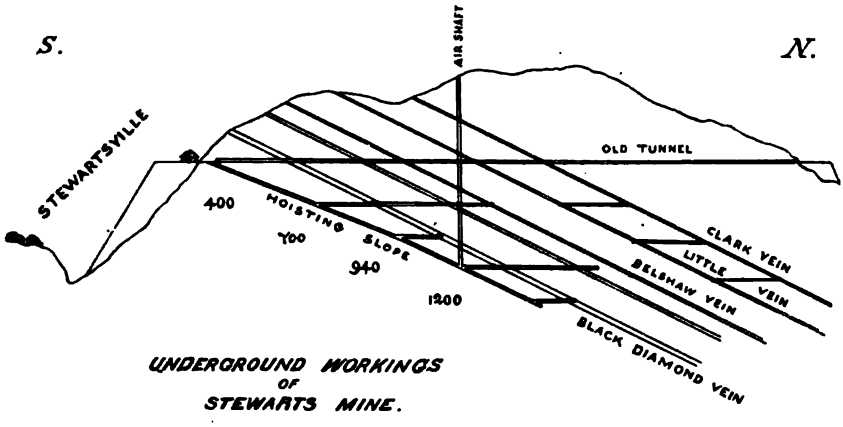
filled with stone (cogs). The gangways and tunnels have a 1 per cent grade toward the foot of the hoisting slope in order that the water may drain from the whole mine into the sump and the loaded cars run easily.

Stewart (Central) Mine.—The next toward the W. is the Central or Stewart Mine at Stewartsville. This mine lies nearly in the center of Sec. 10 on the S. slope of a very steep sandstone ridge. It was opened many years ago by a tunnel driven N. entirely through the hill; after crossing the other veins the Clark vein was struck at a distance of 1,000 ft. from the mouth. It proved to be the only good coal found. Gangways were driven at this place and all the coal extracted from above; a slope was then sunk 900 ft. on the pitch of the vein, a hoisting engine placed at the head of it, and the entire coal extracted. Then from the bottom of this 900 ft. slope a tunnel was run S. 218 ft., where it struck the Little vein. Coal from this vein was mined here and there, and as high up as possible wherever its thickness admitted of doing so at a profit. The Black Diamond vein was not prospected at this level, as further progress was stopped by insufficient ventilation, caused to some extent probably by the underground hoisting engine. Water also came in at the rate of 150 cu. ft. per hour, so work was temporarily stopped. Later the present workings were opened by driving a slope down 1,200 ft. near the mouth of the old tunnel, at an angle averaging 20°, and sinking an air shaft 312 ft. from top of the ridge to the old tunnel, and thence down, at an angle of 55°, until it struck the 1,200 ft. slope at a point 900 ft. from the surface. The first tunnel to tap the coal was driven at a point on the slope 400 ft. from the surface; it cuts through 160 ft. of light-grayish sandstone and strikes the Black Diamond vein.

Section of Formation Penetrated by the 400 ft. Level.

Gray sandstone			160′	
Black shale and bone with 6 in. coal	Black Diamond vein		6′	
Black clay			6′	
Coal of good quality			2′	
Clay				2″
Coal not as good as above			1′	6″
Dirty white slate			5′	
White sandstone			200′	
Shale and bone			10′	
Coal				10″
Bone				10″
Coal			1′	
Black shale			2′	
White sandstone			105′	
Black shale	Belshaw vein		5′	
Coal			2′	6″
Yellow sandstone in face of tunnel.				

The upper old tunnel for quite a distance runs along in a fault, and no sign of the Belshaw vein was noticed; later, when the air shaft was sunk, the vein was crossed in good ground and proved to carry 2½ ft. of excellent coal. Up to that time the Black Diamond vein was the only one worked from the new slope, as the Clark and Little veins had already been mined through the old workings. The result was that the tunnel on the 400 ft. level was extended and the Belshaw vein struck as shown above. A gangway 800 ft. long is driven on it toward the W., and the coal is being extracted there now. The vein has a dip of 25° to the N., and as a rule the roof is clean white sandstone, although in places a few inches of shale intervenes. The bottom is 5 ft. of shale.

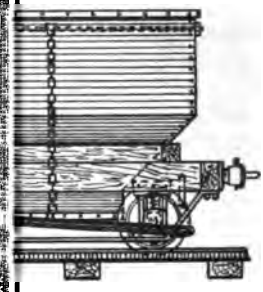


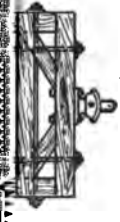
UNDERGROUND WORKINGS OF STEWARTS MINE.

The coal averages 30 in. thick, and is clean and bright. It is intended to drive the gangway some 200 ft. farther, to a large fault known to exist there. About 15,000 sq. yds. of the vein have been extracted. At a point 700 ft. down the slope a tunnel was run to mine the coal of the Black Diamond, and another one 940 ft. down is being extended at present to cut the Belshaw vein. It is in 320 ft., and it is expected that the vein will be struck within the next 40 ft. At the base of the slope, at the 1,200 ft. level, there is another tunnel, which cuts the Black Diamond vein. But very little coal has thus far been taken from here.

The hoisting slope cuts through solid yellowish sandstone all the way down. It is 6 by 6 ft. in the clear and not timbered. The tunnels are timbered wherever they cut the different veins or carbonaceous streaks. The sandstone does not require timbering. The gangways are timbered throughout with 8 by 8 in. timbers. Props are redwood, 3 ft. long, and averaging 5 by 5 in. square. Ninety props make a cord, and cost $6 25 in Antioch. In tunneling two men make about 7 ft. per day. Giant No. 2 is used in 1¼ in. cartridges, and boring is done with hand drills. The ventilation throughout the mine is good. Water is hoisted in self-filling wooden tanks at the rate of 120 cu. ft. per hour from the sump on the 1,200 ft. level. The engine has a cylinder 12 by 20 in., and a ⅞ in. wire rope is used, winding on a drum 7 ft. in diameter. The rope is run at a speed of 9 ft. per second. Water for the boilers is brought up by rail from Antioch; about 3,000 gallons are used per week. The coal in the different veins, as far as they are mined, was of uniform quality, except, of course, where it was crushed by faults. Small faults are quite numerous, and large ones exist on the western as well as the eastern end of the claim; both are about one fourth of a mile from the main slope. It was noticed that the coal was 3 to 4 in. thicker at the west than at the east end of the workings. About 30 men are employed about the mine, but like the Star Mine the number varies greatly from time to time. The coal is screened into two qualities—a nut coal and slack. A narrow gauge railroad carries the coal from the Star and Central mines to Antioch, where it is dumped into barges and sold. Shipments from these two mines average 3,000 tons per month.

The next mines farther west lie in Secs. 5, 6, and 7. See our VIIth Report, pp. 117–140. Abandoned in 1886. The railroad to the river





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Little" vein, the only one
toward the south along the
lowing section:

	3′	
	1′	
	2′	
	3′	6″

Although the dip is 33°, sheet-iron was used in the chutes. From the gangway a cross-cut was made to the west, and several small streaks of coal were found, but before the "Big" vein was reached water came in and the work was stopped. The mine is dry, except where the cross-cut enters the gangway. About a barrel of water is dipped up at that place daily. The manner of mining is the same as in the San Joaquin Mine. The clay here, being dry, does not swell, and but little timbering is required; 6 by 6 in., and even 4 by 4 in. posts seem to do the work required of them. The cars run on strap rails, pushed by men and dumped at the bunkers. The coal is hauled by wagon 5 miles to Coalinga, on the railroad. In 1893 the average shipment was 100 tons per month. The coal looks somewhat brighter that that of the "Big" vein, and contains less ash.

Carey Creek Coal.—On the north side of the metamorphic ridge, where the hills are not covered so deeply with soil, coal has been found in many places. On Mr. Frame's place, in Sec. 6, T. 22 S., R. 14 E., prospectors are at work. They are said to have a vein of good hard coal 6 ft. thick. Their cut was filled up by a landslide, and they are now at work on a tunnel to cut the vein in a better place. The locality lies perhaps only 100 ft. above the metamorphic rock, and the strata dip 45° N.E.

Coalinga Coal Field.—In the S.W. corner of Fresno County, at the end of the railroad from Goshen to Alcalde, two veins of coal crop out along the lowest foothills of the Coast Range. In nearly every one of the many little cañons for 20 miles N. as well as S. from Coalinga the carboniferous strata can be noticed. As a rule they dip away from the range at a rather high angle. Very little work has been done in the way of prospecting, and except in the vicinity of Coalinga no coal is mined because of lack of transportation facilities. Two veins are large enough to mine, of which the upper one, containing probably the best coal, is called the "Little" vein. It varies in thickness from 6 in. to 2 ft.; the lower one, called the "Big" vein, is 4½ ft. thick where it is now mined. The coal measures are covered with a series of thin beds of soft, light-gray sandstones interstratified with argillaceous shales. Two mines are being worked on these veins, viz.: The California and the San Joaquin Valley mines.

Drabble Mine.—On the eastern edge of Priest Valley, in Sec. 26, T. 20 S., R. 12 E., two tunnels were run into the hill by Mr. Drabble. The cropping shows two large veins of carbonaceous matter; the lower one is probably 100 ft. thick and contains three workable seams of coal; the upper one is not nearly so thick. The tunnels are cutting the lower cropping only. The first one starts in a little ravine high up on the hillside and 25 ft. below the cropping, and runs 71 ft. nearly N. to a gangway on the vein, which was driven 65 ft. to the E. The vein at the face of drift shows 3 ft. of clean, bright coal. The tunnel cuts the strata below the coal as follows:

Mouth of tunnel.		
Gray sandstone	23′	
Blue clay	5′	
Thin seams of coal and sand	1′	4″
Bone	1′	
Coal		7″
Bone		8″
Coal		6″
Blue clay and bone	5′	6″
Gray, soft sandstone	20′	
Gray clay	4′	

Sand	3'	
Gray clay	6'	
Coal	3'	1"
Hard blue slate.		

The second tunnel is only just begun and lies in another gulch, probably 1,000 ft. farther down the creek, and starts on the cropping. The dip is 61° N., and the strike S. 70° E., and, as is generally the case in gulches, there is a fault in this one. No doubt as the tunnel advances beyond the influence of the faulting the coal will come in with its proper thickness of 3 ft.

On completion of a wagon road, which is in course of construction, Mr. Drabble intends to ship coal to the cities in the San Joaquin Valley via Alcalde. The quality of the coal seems to be somewhat better than that of the Black Diamond vein at Mount Diablo. A tunnel run into the hill at the bottom of the gulch would strike the coal in 800 or 900 ft., and have stoping ground above it of perhaps 700 ft., while the mine would drain itself should water come in.

There is a tendency among prospectors and miners to make their openings in gulches, and this may be the proper thing to do under certain circumstances, but it is decidedly wrong in prospecting or mining for coal. In soft sandstone, thrown up from its original level position, a gulch is almost always the result of a fault or break in the strata. The coal is the most fragile layer in the formation, and in faulting it will be the first to be crushed and mixed with the accompanying clays to form bone, or it may be burnt by the heat generated and leave nothing but ashes. At any rate the prospector does not gain the information he desires (*i. e.*, thickness of vein and quality of coal), and has to use two sets of timbers where in solid ground he would use but one.

Priest Valley Coal Field.—By far the most important discoveries of coal thus far made in the State are in the neighborhood of Priest Valley in the Coast Range. The beds extend through T. 22 S., R. 14, 13, and 12 E.; T. 21 S., R. 14, 13, and 12 E.; T. 20 S., R. 13 and 12 E.; T. 19 S., R. 12 and 11 E.; and through R. 10 E., T. 18 and 17 S., in San Benito, Fresno, and Monterey counties. The coal occurs in a soft, dark bluish-gray, Cretaceous sandstone several thousand feet in thickness, lying on both sides of a high ridge of metamorphic rocks, which traverses the country in a N.W. and S.E. direction. It forms the divide between the waters of the San Joaquin and Salinas rivers from the S. line of T. 22 S., R. 14 E. to about the center of T. 20 S., R. 12 E.; thence it swings more to the W. and crosses Lewis Creek about 3 miles above the mouth of Oat Cañon. It includes the Stone Cañon and the Drabble Mine croppings on Carey and Warthen creeks, and extends through Priest Valley into San Benito County.

San Joaquin Valley Company's Coal Mine.—Since our XIth Report, p. 217, at a depth of 200 ft., a tunnel 150 ft. long has been run in a westerly direction from the incline and struck the "Little" vein in a fault. The coal in this vein, although of good quality, was only 1 ft. thick. Turning to the N. here they drove the tunnel along the vein 200 ft., but as the thickness did not increase the vein was abandoned. They then turned to the W. again and drove 70 ft. and found the "Big" vein. A gangway was then run 250 ft. toward the N.W., and coal is being mined from there now. The lift is 225 ft. The dip of the coal varies from 32° to 40° toward the E. The mine makes about 240 cu. ft. of water

per hour, and by far the most of it comes from the streak of soft sandstone below the "Little" vein. At the foot of the slope a stratum of hard bituminous sandstone, with shells, was cut through, from which black petroleum exudes and flows down into the sump. The blue clay above and below the coal causes great trouble and expense in this mine. As soon as a gangway is opened and the clay exposed to the air, it swells and squeezes the timbers out of shape or crushes or breaks them where they cannot give. The timber used is 10 by 10 or 12 in. sawed pine, with lagging of 2 in. plank. Old redwood railroad ties are used to some extent for props and caps. The coal is mined in rooms 30 ft. between chutes, leaving a pillar alongside of the gangway 25 ft. thick. There is no pillar left between the rooms, everything being taken out. The dip of the vein is sufficient to run the coal in the chute without the use of sheet-iron and oil. In the rooms a post and cap is set every 3 ft. in all directions. The 7 in. of gray slate comes down with the coal and must be picked out. The ventilation is good without artificial draft, the air circulating through the old workings above. Much gas was expelled soon after the lower tunnels were driven, and some of the men were slightly burned, but at present there is none worth mentioning. The coal of the "Big" vein is not as bright as that of the Belshaw vein at Mount Diablo. It has a reddish-black color and crumbles easily when exposed to the air. The following section of the strata was taken with difficulty on account of faults and the many windings in the tunnel:

Starting at the top of the hoisting slope.		
Thin strata of slate, clay, and sandstone	160′	
Blue-gray sandstone	20′	
Base of slope	3′	
Black sandstone soaked with bitumen	3′	
Hard gray sandstone	28′	
Very hard gray sandstone		5″
Poor coal		4″
Soft blue-gray sandstone	20′	
Blue clay	5′	6″
Poor coal		3″
Blue clay	18′	
Soft blue-gray sandstone or sand (emitting gas)	10′	
Hard cemented pebbles and shells	1′	
Good coal (little vein)	1′	
Blue-gray clay	27′	
Soft blue-gray sandstone	2′	
Poor coal		2″
Blue-black clay	1′	6″
Soft crumbly coal		7″
Blue-black clay	2′	
Gray clay	5′	6″
Black shale		7″
Coal (big vein)	4′	6″
White sand	4′	
Blue clay.		

In the length of the gangway the strata differ considerably in thickness. At the face, sandstone lies above coal, replacing the clay of the section, and in places the shell cement above the "Little" vein is wanting, sandstone forming the roof. Steel "T" rails are used in the mine. The cars hold about 1,400 lbs., and are hoisted by a small double steam engine. The mine makes about 240 cu. ft. of water per hour, as stated above. A Cornish pump running eight hours per day keeps it dry. An old steam pump stands at the base of the incline, but it is not in use now. The company ships about 300 tons of coal per month, mostly to Fresno, where it sells at $5 50 per ton. Freight costs $1 50 per ton. A

branch railroad, 2½ miles long, runs from Coalinga to within one fourth of a mile of the mine, and the mine cars run by gravity to the bunkers; when empty they are hauled back by horse-power.

Warthen Creek, Coal on.—All along the south side of Warthen Creek, through the whole of T. 21 S., R. 13 E., croppings of coal are found, but beyond a little scratching no work has been done. On Hot Springs Creek, in Section 12 of the same township, Mr. Crump said he opened a coal mine several years ago and found two veins, one 3 and the other 1½ ft. thick. The sample of coal shown as coming from these veins is harder than any California coal that the writer has seen. The location is 9 miles from the end of the railroad at Alcalde, and it might pay to ship coal into the San Joaquin Valley. At Mud Springs, on the Old Vaughn place, Sec. 36, T. 20 S., R. 12 E., a cropping of carbonaceous matter crosses the gulch. The strike here is N.W. and S.E. and the dip probably 80°.

HUMBOLDT COUNTY.

Alder Point.—Near Eel P. O.; mentioned in our Xth Report, p. 207, but nothing of value exists here. The coal occurs in thin seams in much disturbed gray sandstone.

Buck Mountain Creek.—Two miles from its mouth is the next cropping, N.W. from the Ray ranch. It is said that an opening was made here and some coal taken out which proved to be of good quality. Float found in the creek below seems to confirm this statement. The writer did not succeed in finding the hole or the cropping, although he went far beyond the point where they were said to be. Recent landslides must have covered them up. About a mile below Garberville a place was shown near the water's edge in the river, where a few years ago coal of good luster and hardness cropped out several feet thick, but the river has washed in a lot of sand and gravel and covered up everything many feet deep.

Garberville.—In this vicinity the South Fork of Eel River winds its way through a heavy bed of unaltered yellow sandstone, intercalated with clay shale and beds of gray clay, belonging probably to the Tertiary age. The formation lies non-conformably upon the gray metamorphic sandstones. It has a dip of 38° N.E. and a strike N.W. Throughout the district lumps of bright black coal are found as float in the streams, and are collected and used for blacksmithing. The bulk of this float comes from pockets and irregular veins in the sandstone, and is the result of conversion into coal of a few or even a single tree at any one place. It resembles in appearance and composition the coal found in Round Valley.

Harpst Mine.—On Mad River, a short distance above the mouth of Boulder Creek, Mr. Harpst found some coal and made an open cut into the vein to prospect it. The vein is about 3 ft. thick and is composed of a number of thin seams of coal, alternating with serpentine (in this case metamorphic shales). The vein lies in serpentine and is twisted and warped parallel to the strata of that rock. What little there is of it is a soft, bright, greasy-looking coking coal, containing 45 per cent of ash, consisting principally of sulphate of lime. The coal is of no commercial value, but the occurrence of it in the serpentine is of great interest, in so far as it proves the sedimentary origin of the serpentine conclusively

and may lead to the determination of its age, which at present is still an open question.

Hydesville.—Near here, on the sandbars of Van Duzen River, just above the mouth of Yager Creek, is a large amount of float coal. Somewhere above, a good-sized vein must be exposed to erosion by the river. The coal is a young lignite of good quality, resembling that from Poison Camp in general structure and appearance. It is darker in color when dry and is brighter when broken across the fiber. Although a much younger coal than that from Mount Diablo, for steam purposes it is fully equal if not superior. It makes a quick hot fire, does not contain much ash and does not crumble into dust. The cropping occurs probably not more than 4 miles from the end of the railroad at Hydesville, and the intervening country is inexpensive to build over. Should the coal vein be found to be of sufficient size to mine and the railroad extended to it, there is no reason why it would not pay to ship the coal to San Francisco.

Preston Mine.—Proceeding from the coast up Mad River, serpentines and metamorphic schists form the mountains on both sides as far as the village of Blue Lakes. Here Tertiary sandstone again appears, and extends up the river on the north side to a point a few miles beyond Boulder Creek, thence swinging to the north and leaving the river. Float coal equal in quality to that found in Van Duzen River, near Hydesville, can be gathered in many of the creeks flowing into Mad River from the north, and in Maple Creek croppings of the veins have been discovered and some prospecting done. A shaft in the creek bed is said to have been sunk to a depth of 70 ft., but no trace of it can be found. A small heap of much decomposed and impure crumbled coal lies on the bank of the creek, from which samples were taken. Only conflicting statements could be obtained from the men who worked in the shaft; they are not practical miners, and their estimates of thickness of the coal vary from 2 to 9 ft. Immediately below the shaft a bed of soft gray sandstone shows across the creek, with a strike of N. 20° W. and a dip nearly perpendicular. Up Maple Creek a distance of 500 ft., Crogan Creek comes in from the S.W., where large pieces of tough lignite of brown hue were found. Apparently, the vein crosses the creek close to its mouth, but the cropping did not show. A short distance beyond another small stream runs into Maple Creek from the same direction, and in it, 300 ft. from its mouth, a 4 in. vein crops out, lying in gray sandstones with a dip of 20° N.N.W. One thousand feet beyond this is a vein 6 in. thick, in blue clay, while 300 ft. farther a larger vein crosses the stream. It is a tough brown lignite of good quality; its thickness could not be determined. The piece forming the cropping extends clear across the creek, 10 ft., and is 2 ft. thick. It weighs possibly half a ton, and lies with a dip of 20° to the N.N.W. For a distance of 40 ft. above this, coal shows in patches in the bottom of the creek, and certainly one very large or several smaller veins must exist there. Wall rock is not exposed, but judging from the configuration of the surface it is clay or at least soft material.

Two miles down Maple Creek, on Mr. Fale's place, float coal was found in a small tributary, and a mile farther down, near the junction of the road with the creek on Marshe's ranch, coal shows in the bank of a little stream that flows into Mad River 1,000 ft. below the mouth of Maple Creek. The vein is 18 in. thick, and lies in blue clay, with a dip of 40°

W.S.W. In quality it is a dull, earthy brown coal, and when wet resembles somewhat the Ione coal.

Ray Ranch.—It is in T. 5 S., R. 4 E., 7 miles S.E. from Garberville, and on it coal crops out in a little creek which empties into the east branch of the South Fork of Eel River, about 1,000 ft. E. of Mrs. Ray's house. The creek has cut its way into the sandstone nearly at right angles to the strike of the strata, and three veins are exposed; another is said to exist, but is now covered up. They show a dip of 36° to the N.E. Below the coal lies a gray clay shale; 14 in. of coal; 12 ft. of the same shale; 3 ft. of coal; 8 ft. of shale; 1½ ft. of coal, and the whole is covered with yellowish clay mixed with sand. The coal having been exposed to the weather for years, looks very poor. It has weathered into thin laminæ of a dull slaty black color, which break up readily in the hand. Lumps of highly bituminous glistening black coal are found scattered through the mass. The value of these mines cannot be determined at present, or until opened in solid formation. The sample analyzed (see end of this chapter) was taken from the surface and contained a large percentage of impurities infiltrated from the muddy stream, which show in the ash.

MENDOCINO COUNTY.

In Mendocino County there are found three beds of lignite, which traverse the country in a N.W. direction, nearly parallel with the seacoast and with each other. The most westerly bed crops out in many places immediately along the coast and is mentioned in our previous reports. It consists of one or more thin seams of excellent coal, varying in thickness from an inch to a foot. Nowhere, however, has coal been found in sufficient quantities to be of commercial value.

The second bed exists 12 to 25 miles from the coast. Croppings occur at Doolan Cañon and on Ackerman Creek, near Ukiah; in Walker Valley, 4 miles S. of Willits; at the head of Ten-Mile River, on the road to Westport, 2 miles S.W. of Cahto; on Mill Creek near Cole's Station, and farther north in Humboldt County on the Upper Mattole, and near Camp Grant on Eel River. Like the first bed it generally contains a good quality of coal; some of it will coke, but as far as known, the seams seldom exceed a few inches in thickness and are too thin to mine.

The third bed lies 15 to 20 miles still farther inland, and contains a vein of great thickness and value. It is exposed in Middle Eel River south of Round Valley. The existence of this coal has been known for many years, but the locality where it occurs lies in the very heart of the Coast Range, in a country cut up in every direction by rocky and crooked cañons thousands of feet deep and traversed by mountain ridges of great height and grandeur. Capital so far has not seen its way clear to build a railroad into this region, and communication with the rest of the State is limited to the pack mule and wagon. A railroad survey was made years ago from Ukiah to Eureka in Humboldt County, following the redwood belt on the South Fork of Eel River near the coast, and a branch was run down Outlet Creek to Eel River, and thence to the coal bed. Construction, however, was never commenced. The Fort Bragg Lumber Company is building a railroad from the coast to Willits, and it is expected that this line will be extended to the coal field. In the summer of 1894 it was engaged in making a survey for a railroad to Round Valley, via Eel River.

Many industries might be developed were proper transportation facilities provided. Yellow and sugar pine grow on the higher mountains, while spruce, madrone, and oak cover the hillsides. Tan-bark in inexhaustible quantities can be collected. Chromic iron and manganese ores of remarkable purity exist in several localities. Mr. Shimmin found both near his ranch at the head of Tomki Creek.

Eel River Mine.—The coal beds can be traced for many miles, but the only place where the vein has been prospected extensively is in the Middle Eel River, opposite the mouth of Salt Creek, in Sec. 1 or 2, T. 21 N., R. 13 W. The first discovery was made in the river just below where Salt Creek comes in. The vein here crops out across the river with a dip of 31° E. It shows a thickness of 14 ft., with a seam of whitish slate 3 to 6 in. thick near the middle. A section taken shows:

Top stratum not exposed.		
Blue clay shale, weathering into small fragments	26′	
Coal of good quality and luster	5′	6″
Soft white slate, containing sulphate and carbonate of lime		3″
Coal of dull luster	8′	
Sticky blue clay, containing minute shells	21′	
Same clay, containing oyster shells	1′	
Soft gray agglomerate, containing clay and fragments of serpentine and sandstone	5′	6″
Soft greenish metamorphic sandstone	30′	
Serpentine beneath.		

About 1,000 ft. up the river there is a cliff 60 to 80 ft. high, of a very hard greenish metamorphic rock, and the strata seem to lie conformably upon the coal. Going north from this cropping half a mile, perhaps 300 ft. above the bottom of the river, several openings have been made. A tunnel, said to be 400 ft. long, is run in on the vein on a course of N. 10° E. About 50 ft. of this is still open; the rest is caved. The lagging prevents any study of the strata. Several tons of coal lie on the dump crumbled into fragments. Some 60 ft. above the mouth of the tunnel is an incline, 30 ft. deep, driven with the pitch of the vein, showing 7 ft. of coal, with coal for bottom and roof. Below the coal, or west of the openings, a hard gray metamorphic sandstone covers the ground, but of its thickness and position nothing could be seen. A few hundred feet east of these openings metamorphic rock occurs again in the shape of a perpendicular cliff 400 to 500 ft. high, forming quite a feature in the landscape. The rock is very hard, of a greenish color, and contains iron pyrite. It has not been satisfactorily determined whether this cliff is of sedimentary origin or not; although it seems to be stratified, it may prove to be an eruptive dike, in which case it will have cut off the coal vein at a point probably 500 ft. below the surface.

It is a feature to be noted, that here the coal exists in a heavy seam between the beds of rock highly metamorphosed without having undergone any notable change in structure or composition. It is to be expected, however, that as greater depth is reached, the result of metamorphism will be apparent, in so far that the coal will contain more fixed carbons and less volatile matter. In quality the coal is fair; it will crumble to some extent; iron is present in the shape of hematite; no pyrite was noticed. Union Lumber Company, of Fort Bragg, lessees.

Going southeasterly from the cropping in the river, the coal measures can be traced up Salt Creek. About a mile from the river the first cropping occurs. The underlying clay here is substituted in part by a bed of broken shells compacted into a rather hard rock of white color. The

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Mr. H. C. Swain, of the

Merced gasworks, states that he examined a sample of this coal, and that its physical appearance resembled that of the Ione coal; that it burned readily in an open fire, and yielded an ash which in quantity and general appearance resembled the ash from a sample of Ione coal of similar size, which he burned for purpose of comparison.

MONTEREY COUNTY.

Priest Valley Coal Field (See also Fresno County).—Coal lies under the northern half of Priest Valley and the veins extend far into Fresno and San Benito counties. Following the croppings west from the Drabble Mine in the latter county the veins appear again in the creek bed on Sec. 21 on Mr. Clayton's homestead. Here the creek has cut into the side of the low bluff, and the carbonaceous strata are exposed and show a thickness of about 300 ft. About a mile down the creek, near the corner between Secs. 21 and 17, the creek cuts them again. A section shows as follows:

Gray sandstone above.	
Blue shale	60′
Clay stained with iron	12′
Carbonaceous matter with thin seams of coal	15′
Blue clay	5′
Decomposed coal	5′
Gray soft sandstone with clay	2′
Clay rock	10′
Coal	3′

The strike is N. 80° W., and the dip 40° N.E.

Five feet above, another seam appeared, but its thickness could not be measured, as it was partly covered with earth. Some large pieces of nice bright coal which came out of that vein were found in the creek.

The next cropping occurs in Sec. 7 or 12 of the next township, but the hills here are covered too deeply with soil to trace them.

Another set of veins exist 1¾ miles N.E., running parallel to the one just described, and have nearly the same strike and dip; in other words, they lie conformably upon the Drabble bed. The croppings can be traced through Secs. 14, 10, and 9, and probably farther N.W. as well as S.E. There are two veins of carbonaceous matter close together. The upper is 100 ft. thick, and has at least two good sized veins of coal; below this lies 50 ft. of gray sandstone, and then comes the lower vein, which is 50 ft. thick. No work has been done on these veins, and their value is a matter of uncertainty.

Stone Cañon.—This mine lies on the most southerly cropping in the Priest Valley coal field, and in the drainage of the Salinas River. See our VIIth and VIIIth Reports, pp. 172 and 403. Disagreement about the price of the land was the cause of work being suspended several years ago. This property is of importance, for the reason that the vein is very large, and that the coal is hard enough to stand handling. Lumps exposed on the dump to the weather for four years had crumbled but little. The croppings have been traced east to the head of Stone Cañon, and west about a mile beyond the lowest working. No doubt the coal extends many miles beyond these points, waiting for the prospectors to uncover it. Croppings have been found in many places in the cañons of the headwaters of Gaviota and San Lorenzo creeks, which are supposed to be of the same veins as those in Stone Cañon. No work has been done on them as far as could be learned, and they were not visited.

The coal measures in and around Priest Valley will be of great commercial value and importance in the future when made accessible by railroad facilities. A railroad 20 miles long from the present terminus, Alcalde, would tap the field on the east side of the summit, and should it be continued to Hollister or Kings City, short branches to the outlying mines would reach the entire field.

ORANGE COUNTY.

Yoch Mine is situated in Santiago Cañon, about 20 miles from Santa Ana. A vein 12 to 18 in. thick is being worked and the coal shipped to local points by wagon. It is said to give satisfaction.

There are several other prospects of coal in Santiago Cañon, one of which was unusually promising, but being located on railroad land the miners were compelled to stop operations. The workings were not accessible.

In the *Trabucco Cañon* small coal prospects have been discovered, but little work has been done on them. The veins are small. This coal field can be traced in an almost unbroken line around the northern end of the Santa Ana range to South Riverside, and thence on toward Elsinore, in Riverside County, where it reaches its greatest development.

That the coal seams thus far discovered in Orange County will ever become of any considerable commercial importance is extremely doubtful.

RIVERSIDE COUNTY.

The largest coal mine in operation in the southern part of the State is 6 miles W. of Elsinore. The vein is 3 to over 10 ft. in thickness, occurring in sandstones and sandy shales—rocks that are evidently of Tertiary age. It is a lignite and makes a very good heating coal, and is also used quite extensively for making steam in stationary boilers, but is too light for locomotive use. The mine has been opened over an area about 1,000 ft. square, and has produced a large quantity of coal. A remarkable fact in connection with this bed of coal is that diamond drill holes sunk in the foot-wall at the depth of 40 ft. encountered granite, and this underlying granite country and the metamorphic rocks of the vicinity a mile distant contain veins of gold-bearing quartz. Indeed, there is no reason to doubt that a vein of gold rock may not or does not exist directly beneath the bed of coal in question. The gold is faulted from 1 to 10 ft. in several places, but there has never been any trouble in finding the coal at each break.

The mine lies quite flat, dipping 3° to 10° into the hill. It has been opened by a tunnel starting in the foot-wall and running in on a level for some distance. A station has been cut out underground, from which point the main gangway has an up-grade of about 10°. Where the bed of coal is encountered a second station is cut and a large drum set up; from this point to the base of the incline there is a double track, the loaded car furnishing power to draw the empty one up. The system of mining is by excavating large chambers, pillars of nearly equal size being left to support the roof. A few posts and caps are employed. There have been remarkably few caves, considering the scant timbering. The mine is perfectly dry and free from fire damp. At one point a large fire of coal is kept burning on a grate, causing a strong up-cast draft.

SAN BENITO COUNTY.

Oat Cañon.—In Oat Cañon, in Secs. 20, 21, and 28, T. 19 S., R. 11 E., carboniferous strata crop out, aggregating in thickness probably 300 ft. Some work has been done here, but has long since caved. One of the owners said that they had driven a tunnel 20 ft. into the shale and found a 5 ft. vein of coal, with a 3 in. seam of shale, but that the coal was air-slacked and unfit for use, although very bright and black. There are five veins of good coal besides this one; several are 2 ft. thick, but no work has been done on any of them. The dip is 40° E. of N. and the strike E. and W. Gray sandstone lies below as well as above.

SAN LUIS OBISPO COUNTY.

On the Piedra Blanca Grant.—A small seam of coal has been discovered on this grant. It lies on the north side of Pico Creek, 4 miles from the ocean. The deposit is not over 15 in. thick, and probably will have no commercial value.

SHASTA COUNTY.

Cow Creek.—Near here, in Sec. 12, T. 33 N., R. 2 W., there is an extensive outcrop of coal. A number of seams, with thin clay layers between, about 20 ft. thick altogether, have been exposed in a shaft; the thickest of the seams is about 2½ ft.; one is 15 in., and others from that down to a few inches. The coal is said to be of good quality, though not entirely free from pyrites. The roof is sandstone; the floor clay.

Near the Iles place, north of Little Cow Creek, coal seams are also exposed for quite a distance; these beds dip 5° to 10° E., and have not been worked.

SISKIYOU COUNTY.

Siskiyou Coal Mining Company's Mine.—It is on Willow Creek, about 10 miles N. of Yreka, 4 miles E. of Henley, on the S. P. R. R. The developments consist of a 400 ft. incline with an 80 ft. and a 100 ft. cross-cut. It is stated that the vein shows an average thickness of 4 ft., about 30 in. of which is good coal. D. Horn, of Hornbrook, President.

SONOMA COUNTY.

Several seams of coal, varying from 2 to 15 in. in thickness, crop out in the sandstone 8 miles S.E. of Cloverdale. It is said to be of a fair quality, burning with a good flame; the seams are not worked. A shaft has been sunk 20 ft. Owners unknown.

Bennet's Claim.—This is at the head of a gulch about one fourth of a mile from the beach, in the vicinity of Fort Ross, and has been idle for years. A shaft was sunk 80 ft. deep, from which it is reported that a good quality of coal was obtained but no continuous seams were found.

Hauser's Claim.—It is 8 miles E. of Stewart's Point. No work was being done, and little could be seen beyond some black shales.

Pierson Mine.—This is 5½ miles from Mark West Creek, on the ranch of Mr. Wrighton. A shaft has been sunk 150 ft., and a bore-hole continued from the bottom for 50 ft., which is reported to have cut through

three seams, respectively 2 in., 1 ft., and 4 ft. thick. One fourth of a mile south from the shaft are several tunnels, mostly caved in. The uppermost one runs 75 ft. northwesterly to a seam of coal and black shale from 1 to 3 ft. thick. No coal has been shipped from here, and the mine is closed down.

TRINITY COUNTY.

Hay Fork Valley Coal Field.—Hay Fork Valley is an opening in the mountains at the confluence of Big Creek and Hay Fork. It contains nearly 8 square miles of arable land, partly under ditch. Near the village of Hay Fork, coal crops out in the bed of the river at two points. The upper cropping is found a mile below town, and contains two veins of coal, each 2 ft. thick. The dip is 28° S.E. The coal is much decomposed, having weathered into thin laminæ, and no opinion of its quality could be formed. A large log of hard lignite, containing fossil rosin, was noticed in the mass. The lower cropping lies 2 miles below town, also in the river bed, and is of more importance; the section shows a dip of 55° S.E.

Gray sandstone on top.	
Coal	5′
Gray sandstone	30′
Coal	1′
Gray sandstone	40′
Coal	6′
Gray sandstone in bottom.	

The large lower vein is poorly exposed, and the coal dirty and mixed with mud from the river. The upper vein consists entirely of a black, tough lignite of good quality. In the hills north of town the veins crop out again, but the exposure being incomplete, nothing regarding dip, thickness, or associations could be learned. The Hay Fork coal field is more valuable than the one in Hyampom Valley, partly because it is nearer to the railroad, and partly because the upper vein in the lower bed contains true lignite—a substance that will stand transportation, and make a valuable addition to the fuel supply of the Sacramento Valley. Mining could be done at little expense, owing to the clean sandstone roof and foot-wall. No bone or clay was noticed.

Hyampom Valley is at the foot of South Fork Mountain, at the mouth of the Hay Fork of Trinity River. A bed of carboniferous shale crosses the valley near the middle, and croppings of coal are found in the river and on the hillsides. The best exposure occurs in the bed of the river in front of the post office, where 10 ft. or more of coal crops out. What the foot-wall is cannot be seen. Above the coal lies 6 in. of rather hard, blue slate; 34 ft. of soft brown shale; 1 ft. of gray sandstone; 22 ft. of the same brown shale, and next gravel and soil to the surface. The dip is 21° E., but changes within a short distance to nearly horizontal. Following the course of the vein to the N.E. into the mountains between Hay Fork and South Fork the coal is burned out, only small patches here and there having escaped the fire. In the foothills on the south side of the river, at the base of South Fork Mountain, the vein is partially exposed. It shows below the surface soil:

Coal	3′	
Yellow shale		6″
Coal	3′	6″
Yellow shale	1′	
Coal not wholly exposed.		

The dip is 15° S.W. Both croppings resemble the Ione coal in texture and luster, although in quality the one in the river is decidedly better. Two miles up Trinity River from the post office some parties had sunk a shaft, which is now caved. The cropping shows about 8 ft. of coal, dipping at a high angle to the W. It shows the effect of the squeezing it received during the tilting of the beds, in its brighter color and firmer texture. A short distance up the river the accompanying shales are exposed, lying next to a dike of diorite and baked into a hard rock. Two miles up Hay Fork a bed of cemented gravel 200 ft. thick forms the bank on the south side, and some of the harder strata crop as reefs across the river on a strike of S. 20° W. and a dip of 25° N.W. Below that lies blue clay shale 250 ft. thick, and in it occur a few thin seams of coal. Beyond the shale a very hard quartzose metamorphic rock appears, and of this material the mass of mountains farther east is composed.

The Hyampom Valley coal field extends undoubtedly over a great area, and as the veins are large and easily tapped, mining could be conducted at a minimum cost. What the value of the coal might prove to be from a commercial standpoint cannot be estimated until some underground developments have been made, but it is probable that it will stand handling much better than the Mount Diablo coal, and at least equal it in contained carbons. The mountains are *covered* with sugar pine, and taking the timber and the coal together as an inducement, no doubt capital can be prevailed upon to build a railroad into this region, with reasonable certainty of a handsome return on the investment.

Poison Camp.—The metamorphic rocks here are covered by a bed of very soft sandstone and sand of quite recent origin, and in this formation coal occurs, cropping out in Secs. 22 and 15, T. 2 S., R. 6 E., H. B. M. No work has been done on it. The vein is 3 ft. thick; strike N. and S., with a dip of 24° E. Another vein is said to lie above this one, and a cropping was pointed out a little higher up the hill. It proved to be the same vein, however, the dip and the contour of the hill accounting for the seemingly higher position. Immediately below the coal lies white clay 6 in. thick, and below that a very fine grayish-white sand. Above the coal lies fine white sand mixed with clay. The coal is a very young, true lignite, still showing plainly the structure of wood. It is tough and hard, and resembles ebony wood. Its color is a dull brown-black when split parallel to the fiber, and glistening black when broken across the fiber. After thoroughly drying, the color becomes somewhat lighter and the coal cracks. Bunches of bark are seen in the cropping, having a light red color and being hardly changed. Some pieces will float on water. Analysis shows the coal to be good, as it runs high in carbon and exceptionally low in ash; but the sand roof, if it does not change to a harder sandstone on driving under the hill, will make mining for profit almost impossible.

ANALYSES OF CALIFORNIA COALS.

Locality.	Color of Powder.	Color of Ash.	Coking Qualities.	Water	Volatile Matter.	Fixed Carbon.	Ash.	Authority.
Priest Valley—								
Drabble Mine—Upper tunnel, upper vein	Glistening black, brown tinge.	Reddish white.	None	11.25	38.25	38.50	12.00	Mathyas.
Lower tunnel, upper vein	Glistening black, brown tinge.	Dirty white	None	13.25	33.90	38.60	14.25	Mathyas.
Upper tunnel, lower vein	Glistening black	Light red	None	13.25	37.65	36.60	12.50	Mathyas.
Lower tunnel, lower vein	Glistening black	Light red	None	13.00	37.25	31.50	13.25	Mathyas.
Stone Cañon Mine—From dump	Glistening black, brown tinge.	Reddish	Sticks together.	5.25	39.75	49.25	5.75	Mathyas.
Coalinga—								
San Joaquin Mine—Little vein	Glistening black, brown tinge.	Reddish	None	12.00	37.75	39.75	10.50	Mathyas.
Big vein	Glistening black, brown tinge.	White	None	11.25	40.25	31.25	17.25	Mathyas.
California Mine—Little vein				13.25	41.75	35.00	10.00	Mathyas.
1,000 ft. in	Glistening black, brown tinge.	White		11.25	48.50	31.40	8.85	Dr. W. D. Johnston.
Mount Diablo—								
Central Mine—Belshaw vein		Red	None	13.00	36.00	48.00	3.00	Mathyas.
Clark vein				13.47	40.36	40.68	5.52	Whitney.
Black Diamond vein				14.69	33.89	46.85	4.58	Whitney.
Walker Valley—								
Shimmin's Prospect	Glistening brown	Reddish	Soft coke	0.50	17.50	22.00	60.00	Mathyas.
Middle Fork Eel River—								
Main tunnel	Glistening black, brown tinge.	White	None	8.00	39.25	46.25	6.50	Mathyas.
Incline, 20 ft. down, cropping in river	Glistening black, brown tinge.	Reddish white.	None	7.50	17.75	47.75	27.00	Mathyas.
Top streak	Glistening black, brown tinge.	Reddish white.	None	6.75	40.00	47.50	5.75	Mathyas.
Bottom streak	Glistening black, brown tinge.	Reddish white.	None	6.25	31.50	46.25	16.00	Mathyas.
Round Valley—								
Float	Glistening black, brown tinge.	Red	Sticks together.	8.00	48.00	40.75	3.25	Mathyas.
Mill Creek	Glistening black	Light red	None.	10.25	44.75	41.50	4.00	Mathyas.
Mad River—								
Cropping on Marshe's place	Dull brown	Light red	None	10.25	45.00	29.50	15.75	Mathyas.
Harpst Mine	Glistening brown	Reddish white.	Hard coke	5.50	21.75	28.75	45.00	Mathyas.

Maple Creek								
Cropping in gulch above Crogan Gulch	Dull brown	Reddish white	None	14.25	53.75	29.50	2.75	Mathyas.
Cropping in Crogan Gulch	Dull brown	Reddish white	None	14.00	49.80	32.95	3.25	Mathyas.
Preston Mine	Dull brown	Gray	None	12.25	50.75	31.00	6.00	Mathyas.
Poison Camp—								
Cropping	Glistening brown	Light red	None	9.50	41.00	48.40	1.10	Mathyas.
Lancha Plana—								
Orr Mine	Dull brown	White	None	7.50	47.75	20.50	24.25	Mathyas.
Garberville—								
Float from Buck M'ntain Gulch	Glistening black	Reddish white	Soft coke	7.60	46.90	43.25	2.25	Mathyas.
Cropping near Mrs. Ray's house	Dull brown	Reddish white	None	10.10	51.80	31.00	7.10	Mathyas.
Hydesville—								
Van Duzen River float	Dull reddish brown	Reddish white	None	8.75	51.50	35.50	4.25	Mathyas.
Hyampom Valley—								
Shaft 2 miles above post office	Dull black	Red	None	12.25	42.55	41.60	3.60	Mathyas.
Cropping on west side of river	Glistening black, brown tinge	Reddish white	None	10.50	38.65	24.15	26.70	Mathyas.
Cropping in river	Glistening black, brown tinge	Reddish white	None	11.30	40.50	39.70	8.50	Mathyas.
Hay Fork Valley—								
Lower bed, lower vein	Dull slate	Red	None	9.10	34.25	19.15	39.50	Mathyas.
Lower bed, upper vein	Dull brown	Red	None	11.25	47.00	38.25	3.50	Mathyas.
Cropping in hills	Dull brown	White	None	14.00	39.20	31.05	15.75	Mathyas.
Upper bed, containing rosin	Dull brown	Light red	None	10.10	51.80	31.00	7.10	Mathyas.
Eel River—								
East of Covelo	Glistening brown	Reddish white	Hard coke	2.00	15.50	25.25	57.25	Mathyas.
Corral Hollow—								
Main tunnel			None	16.00	39.00	36.00	11.00	Mathyas.
Shaft			None	17.00	38.00	37.00	8.00	Mathyas.
Shaft cannel coal			Sticks together	6.00	57.00	24.00	13.00	Mathyas.
Ione—								
Newman ranch			None	15.00	37.75	38.50	8.75	Dr. W. D. Johnston.
Mine No. 3—Sample No. 1	Dull yellow brown	Blue gray	None	7.00	33.35	11.85	47.80	Mathyas.
Sample No. 2	Glistening black, brown tinge	Yellow gray	None	14.00	42.40	34.35	9.25	Mathyas.
Sample No. 3	Dull reddish brown	Gray	None	12.65	41.60	28.00	17.75	Mathyas.
Sample No. 4	Dull dark slate	Dirty white	None	12.60	40.60	26.55	20.25	Mathyas.
Elsinore—								
Robinson & Rawlins Mine				15.50	40 00	29.50	15.00	Dr. W. D. Johnston.
Dolbeer & Hoff Mi'e-Poorest coal				9.00	38.50	34.25	19.25	Dr. W. D. Johnston.
Best coal				15.40	43.60	27.90	13.10	Dr. W. D. Johnston.
Cheney Mine				19.00	46.50	21.90	12.60	Dr. W. D. Johnston.
Seattle				5.00	40.00	50.00	5.00	Symington.
Nanaimo				2.98	32.16	46.31	18.55	Whitney.
Coos Bay				17.00	36.00	35.00	12.00	Symington.

COPPER.

Copper ore is found in many counties of California, but is only utilized in a few. The copper product of the State fell off materially in 1893 from that of previous years, owing to the fact that the largest company operating, the Union of Copperopolis, while it continued mining, did not smelt any of its ores.

CALAVERAS COUNTY.

The copper mining industry in this county has for many years been an important one, though since the summer of 1893 comparatively little has been done in Copperopolis and Campo Seco. The district and mines have been fully described heretofore. See our IVth, VIIIth, and XIth Reports, pp. 148, 151 to 156, and 167.

Campo Seco (Penn Chemical Works) Mine.—It is 1½ miles N.W. of Campo Seco. See our VIIIth Report, p. 152. Penn Chemical Works of San Francisco, owners; Solon Pattee, Secretary.

Hecla (Copper Hill) Mine.—It joins the Campo Seco Mine on the north. See our VIIIth Report, p. 156.

San Francisco Mine.—It joins the Campo Seco on the south. See our VIIIth Report, p. 156.

Union-Keystone Mine.—It is at Copperopolis, and is the largest mine in the district. See our VIIIth Report, p. 150. Agassiz-Shaw Co., of Boston, Mass., owners.

FRESNO COUNTY.

Copper King Mine.—This is in Sec. 3, T. 12 S., R. 23 E. Developments consist of a 25 ft. shaft, a 40 ft. drift, a 140 ft. tunnel, and open cuts. The workings are partly filled with water. The vein is said to show a width of from 4 to 15 ft. In June, 1894, there was a large amount of ore on the dump, which appears to be chiefly decomposed copper pyrites, with some oxide and carbonate of copper. The country rock appears to be a mica slate passing into gneiss.

Acres Mine.—This is situated in Big Dry Creek Mining District.

Extensive copper leads are said to exist near the headwaters of Kings River.

HUMBOLDT COUNTY.

Red Cap Creek Mine.—On the high precipitous ridge between Red Cap and Roise creeks, a great deal of money has been spent in underground prospecting for copper. Large pieces of float, native copper, and bornite are frequently found in Red Cap Creek and the neighboring country, and have attracted the prospectors to look for a vein of similar ore, but so far all attempts have been futile. The ridge between the two creeks rises perhaps 2,000 ft. above them, and is very steep. Slides, many acres in extent, can be noticed on both sides of the trail. The country rock is a soft slick serpentine, cut through near the summit by a heavy dike of a very hard eruptive rock, probably diorite. Copper float has been found throughout the slide material and in such shape as to lead to the belief that the ore occurs, not in a regular vein, but rather in bunches, as pockets in the serpentine. Although much money has been spent here, the work has been done without any system and does not

demonstrate the existence or absence of a vein of ore. John Daggett, of San Francisco, owner.

MENDOCINO COUNTY.

Native Copper Mine.—It is situated on top of a spur about a mile S.W. from the cabin in Lost Valley. A shallow opening discloses a stratum of serpentine about 3 ft. thick, impregnated with small particles of metallic copper and copper minerals. The strike is E. and W. and the dip nearly vertical. The wall rock consists of the same serpentine, but is barren of copper. C. H. Staut, of Ukiah, owner.

Red Buck Mine.—This is a continuation of the Salinas, and contains some old abandoned workings on the same vein. In the bottom of a gulch a tunnel runs in 35 ft., and at its end a shaft is sunk about 50 ft.

Salinas Mine.—It lies on top of a spur 1½ miles S.E. from Lost Valley. A shallow opening does not disclose the thickness of the vein. The strike is N.W. and the dip 65° N.E. The ore is sulphide and is said to carry nickel. The walls are soft, decomposing serpentine. Dr. G. W. Staut, of Ukiah, owner.

Thomas Mine.—It is on Bratt Ridge, forming the southern rim of Eden Valley, 55 miles N. of Ukiah. The opening made several years ago is caved, and nothing could be seen of the vein; there are several hundred pounds of ore, rich in copper sulphurets, on the dump. It is to be reopened soon. W. T. Thomas, of Ukiah, owner.

NEVADA COUNTY.

The same counties that are known as belonging to the auriferous belt of California may be considered as those containing copper ores. Along the entire west side of the Mother Lode belt, developments of copper ores are continually met with, and for the most part, under very favorable conditions for working, being mainly at an altitude which permits of operations being carried on the year round in the open air, and in a locality well supplied with water power and timber.

Golden Eagle Consolidated.—This property is 2½ miles N. from Spenceville. The ores contain with the copper an appreciable amount of gold, the copper being almost entirely in a sulphide condition.

Imperial Paint and Copper Company.—These works are in Secs. 35 and 26, T. 15 N., R. 6 E., at Spenceville. Fifteen men are employed. The company hold 220 acres of land. The ore workings consist of a pit, N.W. and S.E., along the course of the vein, 100 ft. deep, 200 ft. long, and about 100 ft. wide, from the bottom of which a drift has been extended on the ore body. In this opening stands about 40 ft. of leaching-water, which, when sufficiently strong, is hoisted out in iron buckets lined with tar and passed through a series of sluices filled with old scrap iron. Above the opening on the hillside is a dump, formed from the material taken out of this hole, placed over tar-coated sheets, estimated to consist of 150,000 tons. This mass has been decomposing, subject to the weather, for over twenty years, during which time the almost solid pieces of iron and copper sulphides have been oxidized and decomposed. The ore seems to form in the slate in large kidneys. Water brought from Dry Creek through 2 miles of ditch is sprayed over the entire heap, washing out the finely divided ore and copper salts. This leach is collected at the lower end of the pile and conveyed to four settling tanks, where the

floating parts are settled, shoveled out, and dried; this goes to make up the "paints." The leach passing clear out of these vats is directed through a long line of 2 ft. sluices, set at a low angle, and filled with scrap iron, on which the cement copper precipitates. This product is shipped to San Francisco to the chemical works for the production of bluestone. About $2,000 per month is realized from this source.

The "paint," after being shoveled out on a platform and dried, is conveyed in cars to the paint mills, where it is passed through a chute that conveys it through rollers; elevators then convey it above a 30 ft. reverberatory furnace with step hearth and five work doors, where three or four charges, of one ton each, are roasted per day, with wood for fuel. The roasted paint is dropped through an opening in the hearth-bottom next the fireplace and spread evenly on an iron platform to cool, when it is passed through a chute under millstones until ground sufficiently fine, when it is again elevated, sifted, and filled into wooden barrels with the help of a patented packing machine. From 25 to 30 bbls., containing from 300 to 400 lbs. per barrel, are produced per day at present. A 50 horse-power engine is required for motive power. A cooperage is to be added. Fifteen men in all are employed around the works. The waste water leaving the works empties into Dry Creek, but is unfit for use. See our Xth Report, p. 392; also XIth Report, p. 313.

ORANGE COUNTY.

Small copper "prospects" have been discovered, and developed somewhat, on the high hills lying north of Trabucco Cañon, 25 miles E. of Santa Ana. They are apparently of no importance. The ore, while rich, occurs only in small pockets.

PLUMAS COUNTY.

A series of copper-bearing veins can be traced across the eastern side of the county. At various points they have been exploited for copper until the price of that metal declined. Later some of them continued active, on account of a paying quantity of gold and silver being carried in the ore. At present they are nearly all being held by assessment work, awaiting a more prosperous future for copper.

Cosmopolitan Mine.—This is on the north side of Genesee Valley, and carries large quantities of sulphuret ores. A tunnel was driven many years ago to cut the vein, but on account of the extreme hardness of the rock, progress was slow and the expense too great at the present prices of copper; hence, the claim has been idle for a number of years.

Engel Mines.—These properties (for there are three distinct claims, designated as No. 1, 2, and 3) are situated 16 miles N.E. from Taylorville, up the north arm of Indian Valley, on the Clarke trail in Union township. The first of these claims is on the left side of Light's Cañon, near the Engel ranch, on the road from Indian Valley to Honey Lake Valley across the Diamond Mountain range, and shows a large amount of "peacock" copper ore, carrying a large percentage of zinc and some iron. It is in the direct course of the copper and iron belt that passes through the country with a general N.E. course. This belt has an approximate length of 40 miles, with a width of about 4 miles, and is about 40 miles from railroad communication. The entire belt is well

supplied with water and timber. No. 2 and No. 3 claims are farther up Light's Cañon, near what is known as Clark's trail. Developments consist of tunnels run into the sidehill on ore; the longest of these is 425 ft., a second 180 ft., and a third 90 ft. These tunnels are about 55 ft. apart. The ore bodies are more in the nature of lenticular masses (kidneys), reaching a width of 60 ft. The ore is mostly low-grade sulphurets, with a little carbonate of copper. Idle, because of low price of copper.

Pocahontas Mine.—This claim is 20 miles from Susanville, 26 miles from Greenville, in Mountain Meadow district; half mile W. of the Plumas County line. The country gives plain evidence of eruptive action; rhyolite, basalt, and amygdaloidal rocks are in close proximity, and nearly all the springs carry copper in solution. The rock in which the copper bodies are found is largely epidote filled with small grains of native copper. The kidneys show large lumps of native copper, with red oxide and carbonates, and also native silver. Millerite (sulphide of nickel) was also found here.

SAN BERNARDINO COUNTY.

Along the Colorado River, south of the A. & P. R. R., and situated from 10 to 40 miles W. of that stream, in the Colorado Desert, are copper "prospects," on which little work has been done to prove their value, yet of which a great deal is heard from time to time.

In the region W. of Vanderbilt and N. of the New York Mountains are many veins and deposits containing copper ores.

In the Ord Mountain District, 12 miles S. of Daggett, are veins containing low-grade copper ores. These veins also contain gold. The copper occurs as silicate (chrysocolla) and carbonate (azurite and malachite). These veins are doubtless more valuable for the gold than the copper they contain.

Amazon Mine.—This is 5 miles E. of Oro Grande. A shaft 60 ft. deep with a drift 56 ft. long in hard rock has not uncovered, as was hoped, a rich body of ore. The work is in a diorite dike impregnated with small crystals of iron and copper sulphide. Near this shaft is a contact of limestone and an intrusive dike, along which considerable copper ore appears. This is the most promising place on the claim. Copper carbonate is found in small quantities in a score of places on the claim. Horace Eaton & Co., of Halleck P. O., owners.

Copper World Mine.—It is about 50 miles N.W. from Vanderbilt. The property has only superficial development. J. H. Boyd, of San Bernardino, owner.

Tiptop Mine.—It is in the Lava Beds District, 36 miles E. of Daggett. Fully described in our XIth Report, p. 354. W. U. Masters et al., of Pasadena, owners.

SHASTA COUNTY.

Blue Jacket Mine.—This claim, 1,500 by 600 ft., is in Sec. 25, T. 34 N., R. 4 W., 1 mile E. of United States Fishery on the McCloud River. This is a late discovery of copper and iron ore 4 ft. wide, between limestone and porphyry, with an N.E. and S.W. course, dipping about 30° N. Assays of the ore show 25 per cent of copper and traces of gold and silver. Three men have started development work.

Cortez Mine.—This is 9 miles S.W. of Round Mountain. The vein has an E. and W. course with a dip of 45° S., between porphyry and conglomerate walls, and varies in width from a seam to 4 ft. The ore carries principally copper and lead sulphides. A tunnel runs on the vein 173 ft.

Peck Mine.—This patented claim adjoins the Afterthought on North Cow Creek, Furnaceville. The ore deposits are near the contact of slate and porphyry. The mine is not worked, on account of the rebellious nature of the ores, which carry a high percentage of copper, lead, antimony, and zinc, and a little gold and silver.

SIERRA COUNTY.

Depot Hill is 5 miles N. of Camptonville. Above it and 300 ft. from the gravel diggings is a belt of serpentine, through which seams of copper ore, mostly carbonates, have been found, having a general N. and S. course. Considerable prospect work by shafts and tunnels was done here about twenty-seven years ago, but at present the property is unclaimed.

TULARE COUNTY.

Copper Queen.—This mine and the extensions thereof are situated above the snow line at the headwaters of the Kaweah River. It is said that the developments consist of open cuts; that the ledge is 150 ft. in width, and that the ore from it contains 18 per cent of copper. Also, that the vein stands nearly vertical, and has a strike of N.E. and S.W., and that one wall is slate and the other granitic rock.

Mankins (Yokol) Mine.—This mine is situated on Yokol Creek and about 9 miles E. of Exeter, on the Porterville branch of the S. P. R. R. The mineral-bearing portion of the ledge is said to be 4 ft. in width.

GOLD.

AMADOR COUNTY.

The mines of this county have long since demonstrated the great depth of the veins on which they are situated, and the possibilities of deep mining. There are a dozen or more shafts which have attained a depth of more than 1,000 ft., and several of more than 2,000 feet. The Kennedy Mine furnishes an example of what may be possible elsewhere. Recently several new mining enterprises have been inaugurated, and some old ones have been revived. The mining industry in "Little Amador" was never in a more prosperous condition. Besides gold and silver, coal, clay, and marble are also among the mineral productions of the county.

Alma Mine (Quartz).—It is on the "Mother Lode," W. of Jackson. A heavy quartz cropping courses N.W. along the hill, to develop which a vertical shaft is being sunk nearly 400 ft. E. of the vein in the black slates. The vein has a black slate hanging- and diabase foot-wall. It is the intention of the company to sink 2,000 ft. on this vein. A large hoist was built in the fall of 1893, the shaft then being nearly 100 ft. deep. Alma Mining Company, of Jackson, owners.

Albany Mine (Quartz).—See New Albany.

Amador Consolidated Mine (Quartz).—This claim, comprising the Eureka and Badger mines, is on the "Mother Lode," S. of Sutter Creek. Described in our Xth Report, pp. 72 and 102. Mrs. N. Green, of New York, owner.

Amador Mine (Quartz).—See Original Amador.

Amador Gold Mine (Quartz).—It is 1¼ miles S. of Jackson, and is fully described in our VIIIth and IXth Reports, pp. 88 and 102. J. H. Tibbetts, of Jackson, Superintendent.

Amador Queen Mine (Quartz).—It is 2 miles S. of Jackson on the "Mother Lode." See our VIIIth Report, p. 91. Idle. An interesting series of transition rock from diabase to talcose schist was obtained in this mine in 1893. They may be seen at the Bureau. W. N. Bardue, of 2443 Mission Street, San Francisco, owner.

Argonaut (Pioneer) Mine (Quartz).—It is on the "Mother Lode," and adjoins the Kennedy on the S., ¾ of a mile N. of Jackson. See our Xth Report, p. 111. Since then a corporation has been organized to thoroughly develop the mine, and a shaft commenced in the hanging-wall diabase, about 300 ft. from the croppings. The dip of the vein at the surface is considerably less than the angle at which the shaft is being sunk (63°), and it is calculated to cut the vein at great depth. It is thought that in depth the vein will assume a greater pitch, conforming to that of the shaft. These calculations are based on the developments of their neighbor, the Kennedy. The shaft has three compartments, the estimated cost of which is placed at $35 per foot, and it is estimated 15 ft. can be sunk per week. In September, 1894, the shaft had reached a depth of 480 ft. Preparations have been made to carry the shaft to a depth of 2,000 ft. Argonaut Mining Company, of Jackson, owners.

Astoria Mine (Quartz).—See New Albany Mine.

Badger Mine (Quartz).—See Amador Consolidated.

Bay State Mine (Quartz).—This is 4 miles N. of Plymouth, and is briefly referred to in our XIth Report, p. 146. Since that time the crosscut has been completed and drifts run N. and S. on the vein. So great was the quantity of water encountered that it was found necessary to construct concrete bulkheads in the drifts in the fall of 1893. In 1894, the shaft had been sunk to a depth of 400 ft., and excellent ore encountered. There are two veins in the mine, lying side by side. The footwall vein is banded and granulated and contains in the interstical spaces carbonate of lime, which causes it to slack and crumble on exposure to the atmosphere. The hanging-wall is massive and firm, but low grade. A light-colored dike rock accompanies the vein. Bay State Mining Company, of Plymouth, owners.

Belmont (Sutter Creek) Mine (Quartz).—This is just N. of Sutter Creek, near the Amador Reduction Works. See our VIIIth and IXth Reports, pp. 73 and 143. In 1893 the hoist at the north shaft was removed to the New Albany Mine. It was said, however, that the Belmont shaft was to be continued down in 1894 with heavier hoisting and pumping machinery. Belmont Mining Company, of Sutter Creek, owners.

Bellwether Mine (Quartz).—It is N.E. of Jackson, on the outskirts of the town. See our Xth and XIth Reports, pp. 104 and 140. S. W. Bright, of Jackson, owner.

Bunker Hill Mine (Quartz).—See South Mayflower.

Clinton Consolidated Mine (Quartz).—It is at Wieland, 6 miles N.E. of Jackson. See our XIth Report, p. 142. This mine was in active operation during part of 1893, but in the fall of that year was closed down, and no reason given. Wieland Bros., of San Francisco, owners.

Colorado and Kate Gray Mines (Quartz).—These are two "prospects," 2½ miles E. of Volcano. The veins are small, but the quartz is rich in gold. W. Q. Mason, of Volcano, owner.

Downs Mine (Quartz).—It is 2 miles E. of Volcano. See our VIth Report, p. 20. R. C. Downs, of Sutter Creek, owner.

Doyle Mine (Quartz).—It is on the "Mother Lode," between the Amador Queen and Amador Gold mines, 2 miles S. of Jackson. See our Xth Report, p. 107.

Elephantine Mine (Quartz).—See New Albany.

Eureka Mine (Quartz) —See Amador Consolidated.

Evans Mine (Quartz).—See Meek.

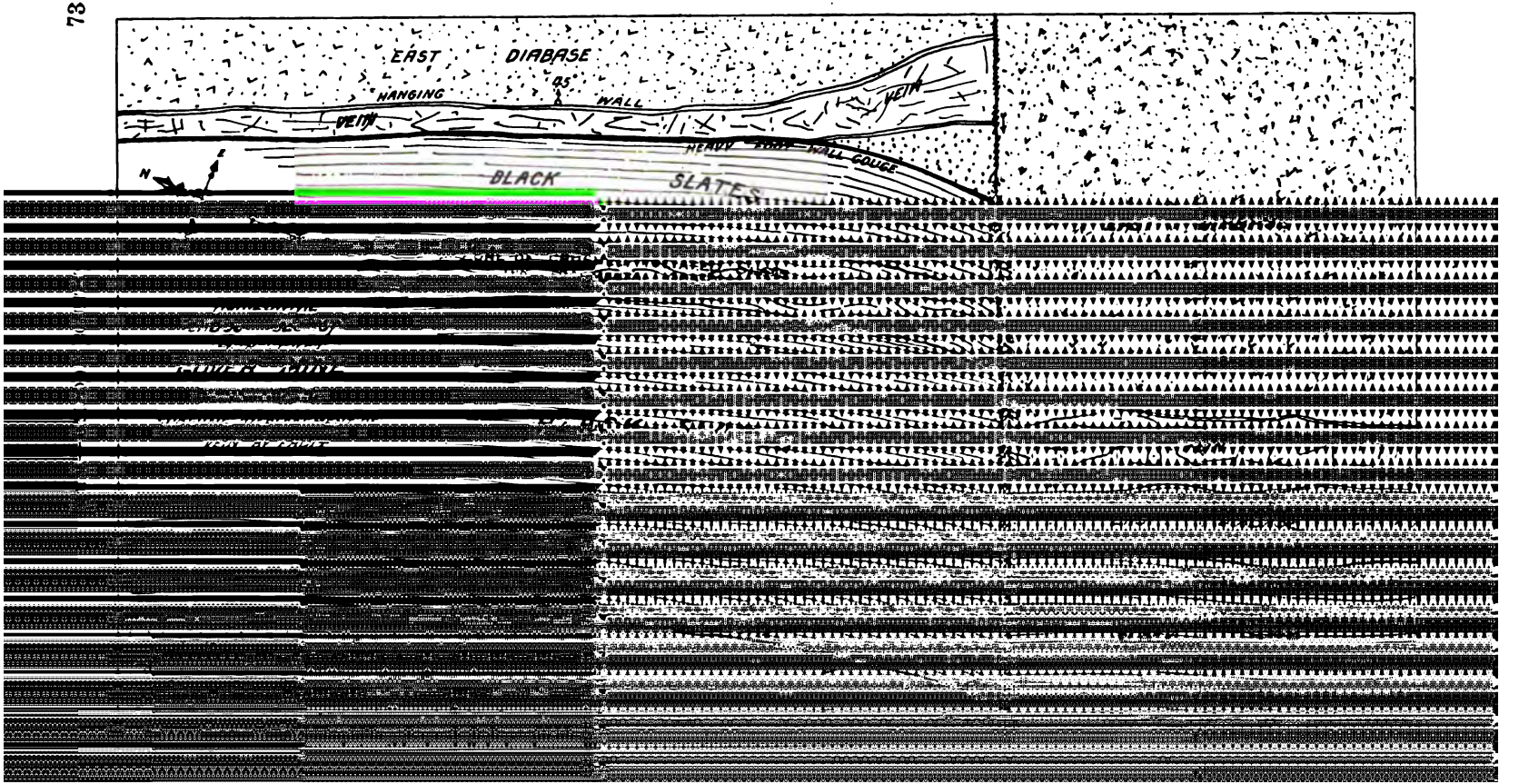
Farrel Mine (Quartz).—It is on the N. side of Mokelumne River, half a mile below Middle Bar. The mine has recently been equipped with a 5-stamp mill, and a force of men is at work on development. James Farrel, of Hardenburg, owner.

Gold Mountain (*Quartz Mountain*) *Mine* (Quartz).—This claim is 1½ miles N.E. of Amador City. Described in our Xth and XIth Reports, pp. 75 and 145. The property was in active operation in 1893. Gold Mountain Mining Company, of 325 Montgomery Street, San Francisco, owners.

Gover Mine (Quartz).—It is on the "Mother Lode," 2 miles N. of Amador City. See our VIIIth, IXth, and XIth Reports, pp. 53, 75, and 146. Important developments have recently been made in this mine. The depth of the mine in the fall of 1893 was 1,362 ft. to the bottom of the sump on the incline, or 1,000 ft. vertical. The south shaft is 700 ft. on the incline, or 525 ft. vertical. There are ten levels run from the main shaft at vertical distances of 100 ft. The longest drift south is 1,100 ft. and north 400 ft. from the shaft. It has two fissures, which at the surface lie between slate and altered diabase. The black slate reef separating these veins is 90 ft. broad at the surface, but widens in depth somewhat. The vein which lies on the east side of the slate, known as the hanging-wall vein, is well defined at the contact to a depth of about 775 ft., where it is pinched. The foot-wall vein continues at the contact for several hundred feet, and then stratifies. A cross-cut on the fourth level passes through a zone of crushed slate, quartz fragments, and veinlets similar to the zone in the Kennedy Mine, which marks the crossing of the vein from the west to the east diabase, and it is not unlikely that the same thing has occurred here. At the ninth level the foot-wall (slate) dropped back, and the shaft, which had followed a contact vein down from the eighth level, is continued on a large vein which has formed in the hanging-wall or east diabase. This ore body, which on the ninth and tenth levels is from 30 to 50 ft. wide, is the largest in the mine. It is more than 300 ft. high, and nearly as long, and has an average width of about 30 ft. Though of a low grade, it is said to be pay-rock. The mine has immense reserves in sight.

It is possible that the vein occurs at the contact of the east diabase and the slate in the lower levels. At this time no cross-cut has been run to determine this.

On the fourth level, 1,000 ft. south of the main shaft, the hanging-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wall vein has been found to leave the contact and strike out into the hanging-wall diabase. The vein is 5 to 6 ft. wide. A heavy gouge which has followed the foot-wall side of the vein continues at the contact, but the formation has been turned back from its course to the west. A drift was run on the gouge seam, which at some distance in encountered a fault. The hanging-wall diabase had been thrust west and was found abutting against the broken edges of the black slates. A crosscut was driven 50 ft. west and has disclosed a mass of quartz in diabase. 12 ft. wide. It is probable that this is the continuation of the vein left in the main drift.

This section of the mine possesses unusual interest, being the first occurrence of a fault on the "Mother Lode" that has been noted.

Along the contacts both east and west the diabase in proximity to the veins has been sheared, compressed, and altered to slaty and schistose magnesian rocks (chloritic and talcose). Complete transitions from normal diabase to soft talcose schist may be seen at many points in the mine.

The large ore body in the lowest levels of the mine greatly resembles those of the Utica Mine at Angels, the quartz often including large and small masses of the altered diabase, which usually contains more or less auriferous iron sulphurets. Gover Mining Company, of Amador City, owners; A. B. Call, Superintendent.

Hardenburgh Mine (Quartz).—It is on the "Mother Lode," 3½ miles S. of Jackson. See our Xth and XIth Reports, pp. 68, 106, and 139. The shaft is down 800 ft. in a heavy crevice, 15 to 20 ft. wide; the material consists of shattered and pulverized fragments of foliated black slate, a little quartz, and considerable clay, with occasional intrusions of altered dike rock. Masses of quartz, much shattered but still coherent, frequently occur, the outer surface being rounded and polished by pressure and attrition in the plane of the fissure, which, like most of the mines of this part of the lode, has been subjected to enormous movement and pressure during a long period of time. This phenomenon is observable in the Quaker City, Gwin, and the intermediate mines. The ground slips, swells, and runs, and requires most substantial timbering. Quartz has made its appearance at two places on the 800 ft. level, but it was very low grade. All energies were being devoted to prospecting. Hayward, Lane & Co., of 224 California Street, San Francisco, owners.

Hollywood Mine (Quartz).—See New Albany.

Irma Mine (Quartz).—This is at Pioneer, 16 miles N.E. of Jackson, in the granite region. In many respects it resembles the mines of West Point District, in Calaveras County. Irma Mining Company, of San Francisco, room 94, Crocker Building, owners.

Kate Gray Mine (Quartz).—See Colorado.

Kelley Mine (Quartz).—It is on the "Mother Lode," 4 miles S. of Jackson. Referred to in our Xth Report, p. 108. Henry Emerson, of Jackson, owner.

Kennedy Mine (Quartz).—This mine is on the "Mother Lode," one mile N. of Jackson. See our VIIIth, Xth, and XIth Reports, pp. 66, 70, 103, and 141. The south shaft has reached a depth of 2,000 ft. below the croppings on the incline, and 1,750 ft. vertically below the collar of the shaft. It is vertical for 376 ft., at which point it makes a bend conforming to the dip (66°) of the fissure. This abrupt bend in the shaft interferes with a rapid movement of the skips. To overcome the diffi-

SLATES

culty a portion of the hanging-wall side is to be cut away, making a curve of greater radius, so that it may not be necessary to slow down when passing this point.

The geology of this mine is very interesting as an indication of possibilities in other mines where the quartz pinches, leaving only a barren crevice. A study of the surface shows several reefs or strips of black slate, intruded by dike-like masses of diabase. A cross-section at the south shaft (see cut), beginning with the foot-wall diabase of the vein, is as follows: Vein, 4 ft.; black slate, 80 ft.; east wall diabase, 200 ft.; black slate, 250 ft.; diabase, 30 ft.; black slate, 35 ft.; diabase, 300 ft.; black slate, 20 ft.; diabase, 200 ft. or more. Northward the strips of slate become narrower and pinch out, with a single exception, the broadest, which extends some distance into the diabase. One thousand feet N. of the south shaft, the black slate is only 25 ft. wide, while the surface diabase is more than 1,000 ft. The vein at the surface occurs at the contact of the west diabase and the black slates, which latter form the hanging-wall. This slate zone is 80 ft. in width, more or less. The vein follows the contact, striking N. 20° W. and dipping 35° to 40° to the E. at the surface. At about 400 ft. in depth the dip is about 50°, and at 700 ft., 60°. Below this, the fissure has a pitch of 65° to 70°. The quartz continued to depths varying from 300 to 750 ft., the latter figure obtaining at the south shaft. Below these limits the fissure left the west diabase; the quartz became stratified, and nothing remained of the crevice excepting a zone of crushed and foliated black slate with fragments of quartz and small broken quartz seams. It was found in sinking that the fissure kept a fairly uniform pitch, while the inclosing rocks approached more nearly in dip to the perpendicular; the fissure crossing the slate and forming a contact with the slate and the east diabase, the latter now becoming the hanging-wall. The quartz reappeared at this contact on the 950 ft. level, and has continued to the bottom of the mine, the 1,750 ft. level. At several points the vein has branched, sending out shoots of quartz into the diabase hanging-wall. The distance on the vein from the croppings to the point where the south shaft intersects the vein is 800 ft. (The levels are presumed to represent the vertical depth.) The vein continued 750 ft. on the incline at the south shaft. The quartz re-formed on the east contact at the 950 ft. level. At the 1,250 ft. level a split occurs, a branch making off into the hanging-wall diabase. It took a low pitch, and it was thought it might lead to a bonanza in the east country rock. A cross-cut was driven east from the 1,350 ft. level and crossed the diabase, measuring 185 ft. horizontally. An upraise of a few feet encountered the vein, which was then followed east to the slate, where the quartz divided and a number of stringers and apparently the fissure came to an end. It has not been followed farther.

Again on the 1,650 ft. level, between the north and south shafts, and at a point where the contact vein is strong and well defined, the quartz strikes into the diabase of the hanging-wall. The vein maintains a nearly true course, while the slates and diabase are deflected to the west several degrees. A heavy foot-wall gouge usually accompanies this vein. This gouge occurs at the place referred to, but does not follow the quartz. It continues, however, at the contact of the slate and diabase. A similar occurrence was noted in the Gover Mine. It will be understood that this is not a split of the vein, but a branching off from the

contact on the strike of the vein. It is presumable that the movement which resulted in producing the gouge occurred subsequent to the formation of the vein, and the fracture followed the line of least resistance, viz.: the contact. The solid vein, which at the contact usually has a distinctly banded structure, has been split and the rock-masses subjected to movement resulting in highly polished surfaces. When the quartz is included entirely within the diabase it assumes a massive structure, the banded appearance of the contact vein disappearing entirely. The size of the vein and value of the quartz in the lowest workings show no deterioration. They are, practically speaking, similar to those above. Ores of both high and low grade are found on these lower levels. In short, the depth appears to form no criterion of the value of the quartz.

A section taken between the north and south shafts shows the quartz to continue from the surface to a depth of 300 ft., where it ends in numerous small stringers. The fissure continues as a zone of barren crushed slate. It crosses the slate belt to the east diabase, the quartz reappearing on the 1,200 ft. level, and continuing to the lowest workings. At 1,450 ft. an off-shoot was found making into the hanging-wall diabase, but at a much higher angle than that on the 1,250 ft. level. This branch on the 1,450 ft. level appears to maintain nearly the pitch of the vein above, the slates and diabase assuming a position nearer the perpendicular.

Opposite the north shaft a section shows the quartz to be continuous to a depth of 300 ft., where it ends. The conditions from that point downward are similar to those already described, the quartz re-forming at the 1,450 ft. level and continuing downward as a contact vein as far as explored.

A notable fact in the Kennedy vein is that the values are not always associated with quartz. In one portion of the fissure in the lower levels the crevice is destitute of quartz, the filling consisting of a mass of lustrous, scaly, foliated, black slate and black putty-like substance (pulverized slate), containing an abundance of auriferous iron sulphurets, for most part coarsely crystallized. This mass is from 2 to 4 ft. in width. It pays well, and is mined and sent to mill together with the more promising-looking quartz.

The idea that pay veins might lie in the hanging-wall country rock is losing favor; the cross-cut on the 1,350 ft. level having failed to develop anything of value. The shoot discovered some years ago in the west diabase has no apparent connection with the Kennedy vein.

This mine is substantially timbered, well managed, and is a model of its class; a fissure vein of moderate width and great depth. The recurrence of a well-defined and rich pay shoot of great continuity at such a great depth, after having pinched near the surface, leaving only a barren crevice in one place for more than 1,100 ft., should prove a great incentive to thoroughly explore veins of this type before abandoning them as being worked out. Kennedy Mining Company, of 404 Montgomery Street, San Francisco, owners; J. F. Parks, Superintendent.

Keystone Mine (Quartz).—It is in Amador City. See our VIth (Part II), VIIIth, and XIth Reports, pp. 16, 63, and 144. Since the last report the main shaft has reached a depth of 1,400 ft. (1,200 ft. vertical), with large reserves in sight. Its geological relations to the wall rocks are quite similar to those of the Kennedy. Keystone Consolidated Mining Company, of Amador City, owners.

Lincoln Mine (Quartz).—It is on the "Mother Lode," half a mile N. of Sutter Creek. See our VIIIth and Xth Reports, pp. 73, 72, and 100. E. C. Voorheis, of Sutter Creek, owner.

Littlefield Mine (Quartz).—See New Albany.

Mahoney Mine (Quartz).—This is just E. of the Lincoln and half a mile N. of Sutter Creek. See our VIIIth and Xth Reports, pp. 73 and 72. It was sold in July, 1894, to the Wildman Company, and its thorough development undertaken. Wildman Gold Mining Company, of Sutter Creek, owners.

Mammoth Mine (Quartz).—This is on the "Mother Lode," near the Mokelumne River, at Middle Bar. See our VIth (Part II), VIIIth, and Xth Reports, pp. 21, 93, 67, and 108. W. E. Nevills, of Jamestown, Tuolumne County, owner.

Mayflower Mine (Quartz).—This is a mile N. of Amador City, and joins the Old Bunker Hill, now called the South Mayflower Mine. A new shaft is being sunk quite a distance back of the vein in the footwall. A long drain tunnel is also being driven in from the base of the hill to connect with the shaft at a depth of 250 ft. Two prospecting shafts are also being sunk on the vein. Mayflower Gold Mining Company, of San Francisco, room 165, Crocker Building, owners.

Meek (Evans) Mine (Quartz).—It is S. of the Zeila Mine and half a mile from Jackson. Several shallow prospecting shafts constitute the development. Ellis Evans & Co., of Jackson, owners.

Middle Bar Mine (Quartz).—See New Albany.

Moore Mine (Quartz).—It is a short distance S. of Jackson, on the "Mother Lode." See our VIth (Part II) and VIIIth Reports, pp. 20 and 84.

New Albany Consolidated Company's Mines (Quartz).—They comprise the Albany, Middle Bar, Astoria, Hollywood, Elephantine, and Littlefield. A hoist was built on the Middle Bar claim in the fall of 1893 and active operations commenced. A tunnel was also run into the Albany Mine on the opposite side of the gulch from the Hardenburgh. As yet these mines, which are on the "Mother Lode," are only in the prospective stage. J. H. Tibbetts, of Jackson, Superintendent.

New London Mine (Quartz).—This property is half a mile S. of Plymouth, and is described in our VIIIth and Xth Reports, pp. 49 and 117. In 1894 the mine is being rehabilitated by an English company.

New York Mine (Quartz).—It is 3 miles W. from Jackson. See our Xth and XIth Reports, pp. 123 and 140.

North Star Mine (Quartz).—This is 2 miles S. of Amador City, on the "Mother Lode" belt. See our VIIIth and Xth Reports, pp. 73 and 99. E. C. Voorheis, of Sutter Creek, owner.

Oneida Mine (Quartz).—This is 2 miles N. of Jackson, on the "Mother Lode." See our VIIIth and Xth Reports, pp. 79 and 109. It has been idle for a long time. Seligman Bros., of Anglo-Californian Bank, San Francisco, owners.

(*Original*) *Amador Mine* (Quartz).—It is in and N. of Amador City.

Philadelphia Mine (Quartz).—It is on the "Mother Lode," 4 miles N. of Plymouth. The course of the vein is N. and S. and dips about 70° E. An old location and patented. J. J. Crawford et al., of Placerville, owners.

Pioneer Mine (Quartz).—This property is S. of New London, about 1½ miles S. from Plymouth. It is one of the oldest locations on the "Mother

Lode," and after an idleness of many years was rehabilitated in the fall of 1893; new hoisting works were erected and prospecting commenced. A shaft has been sunk to a depth of 300 ft., and a fine body of high-grade ribbon rock reported developed. A 20-stamp mill is now (August, 1894) being erected. Dr. Thos. Boysen, of San Francisco (Palace Hotel), owner.

Pioneer Mine (Quartz).—See Argonaut.

Plymouth Consolidated Mine (Quartz).—It is in Plymouth. See our VIth, VIIIth, and Xth Reports, pp. 15, 42, and 117. These mines, once long famous for their long-continued output and large dividends, have been abandoned, and the machinery has mostly been removed. Hayward & Co., of San Francisco, 224 California Street, owners.

Quartz Mountain Mine (Quartz).—See Gold Mountain.

South Eureka Mine (Quartz).—It is a mile S. of Sutter Creek. See our Xth and XIth Reports, pp. 113 and 144. The shaft is now about 1,000 ft. deep. Low-grade quartz was encountered on the 500 ft. level. The fissure consists chiefly of crushed, foliated, and pulverized slate, with an occasional mass of quartz. It is the expressed intention to thoroughly explore the ground. South Eureka Mining Company, of Jackson, owners; J. F. Parks, Superintendent.

South Mayflower (Bunker Hill) Mine (Quartz).—This is owned by the same company controlling the Mayflower, though a separate corporation. See our VIIIth and Xth Reports, pp. 57, 75, and 114. The mine was idle in the fall of 1893, but it was to be reopened in 1894. South Mayflower Mining Company, of San Francisco, room 165, Crocker Building, owners; S. H. Emmons, Secretary.

South Spring Hill Mine (Quartz).—This is half a mile S. of Amador City. See our VIIIth, Xth, and XIth Reports, pp. 80, 73, 98, and 145. It has reached a depth of 900 ft., and is in constant operation. South Spring Hill Mining Company, of Lemonston, Mass., owners; J. R. Tregloan, Superintendent.

Stewart Mine (Quartz).—It is on the hill N. of Sutter Creek. See our VIth Report (Part II), p. 19.

Summit Mine (Quartz).—This claim is half a mile S. of Sutter Creek. See our Xth and XIth Reports, pp. 104 and 144. Idle. John T. Tregloan & Co., of Sutter Creek, owners.

Sutter Creek Mine (Quartz).—See Belmont.

Tellurium Mine (Quartz).—This property is 1 mile N. of Pine Grove, on the Volcano road. A large amount of work, including shafts, tunnels, and underground connections, has been done on this mine, exposing a well-defined vein in mica schist and altered diorite with a gray fine-grained dike rock. Sulphurets of iron, lead, zinc, and copper occur in the quartz, *but no tellurium.* Since the burning of the hoisting works some years ago, it has been idle. N. G. Young, of Volcano, Superintendent.

Valparaiso Mine (Quartz).—This claim is on the "Mother Lode," near Middle Bar. See our VIIIth Report, p. 42. It is scarcely beyond the prospective stage. Joseph Poggi & Co., of Jackson, owners.

Wheeler Mine (Drift).—This is near the village of Pine Grove. The property is partly hydraulic and partly drifting ground. J. T. Wheeler, of Pine Grove, owner.

Wildman Mine (Quartz).—It is within the town limits of Sutter Creek, and is at present the only property in operation at this place.

It is described in our VIIIth, Xth, and XIth Reports, pp. 75, 101, and 144. Since the last report a level at 1,100 ft. has been opened, and sinking is in progress for the 1,300 ft. level. It is said that there are considerable ore reserves above the 1,100 ft. level, though the mill was not in operation in November of 1893. The lower levels of this mine have developed in places 30 ft. of quartz. Where the amount of quartz is small the remainder of the fissure is filled with crushed slaty material and fragmental quartz. In retimbering a portion of the shaft the Superintendent resorted to a novel device to continue uninterruptedly the hoisting in the shaft. A chute, 12 in. square, made of 2 in. planks, was secured to the timbers in a corner of one of the compartments reaching from the 500 to the 600 ft. level. As fast as the old timbers were removed, all the refuse, waste dirt, rock, etc., were sent down the chute to the level below and hoisted in the regular way. As the work progressed (working downward) section after section of the improvised chute was removed. Wildman Gold Mining Company, of Sutter Creek, owners.

Wolverine Mine (Quartz).—This is at Sutter Creek, and lies between the Eureka and Wildman mines.

Zeila Mine (Quartz).—This is in Jackson, on the "Mother Lode." See our VIIIth, Xth, and XIth Reports, pp. 22, 85, 68, 104, and 139. The shaft is at the same level as at the time of the last report. The mine is being operated constantly. Zeila Mining Company, of Jackson, owners.

BUTTE COUNTY.

In this county all the different processes of obtaining gold are being carried on, and generally with satisfactory results. Among the mining properties are found placer, river, drift, hydraulic, and quartz mines. The county has also a large area of the finest agricultural and timber land, and is connected with the central markets of trade by two lines of railroad. With the exception of a comparatively narrow strip next the Plumas County line, the climate permits of work being carried on continuously throughout the year.

Bader Mine (Drift).—This is 1½ miles E. of Magalia. The work is somewhat of an exploratory nature, being carried forward to locate the exact course of the old river-bed, the gravel from which has similar features to that of the Smartsville channel in Yuba County. A bedrock tunnel, 900 ft. long, passes through a limestone belt, besides cutting through two quartz veins between slate walls. The course of the tunnel is N. 30° E., and it has tapped a fine body of old river-wash. It is still being run ahead to intersect the channel at a bend. For the first 700 ft. the tunnel required close and heavy timbering. The gravel drifts are 4½ ft. high, timbered with single posts and caps. About 7 in. of water comes from the tunnel and is used for washing the gravel. The dump holds about 40 carloads, of 1,500 lbs. weight each. The gold is worth $17 50 to $18 per ounce. G. Strauss et al., of San Francisco, owners.

Bangor Mine (Drift).—This is 1 mile E. of Bangor, in T. 25 N., R. 5 E. The company claims 2,400 ft. The channel, running N.W., is opened through a shaft 135 ft. deep and 4½ by 6 ft., closely planked. The main gangway is 305 ft. long, working up channel. The gravel drifts are from 25 to 35 ft. deep, and are carried 6 ft. high. The channel is 300 ft. wide

in the upper part, and about 80 ft. in the deeper part, which is somewhat cemented. There is about 40 per cent of cobbles and bowlders in the gravel. The best pay is in the cemented gravel; each breaster takes down 3 carloads per shift. The gravel is hoisted and run over a grizzly and through a 12 ft. arrastra run by steam power, which discharges through 180 ft. of 14 in. flume, with a grade of 14 in. to the rod. The upper boxes are cleaned up once a week, the remainder once a month. The gold is "scaly," and sells for $18 15 per ounce. About 500 ft. of the channel have been worked; 1,750 ft. remain to be mined. Steam power, supplied from a 40 horse-power engine, does the work, 2½ cords of wood being consumed in twenty-four hours at an expense of $3 75 per cord. Twenty-four men are employed. See our XIth Report, p. 164. F. W. Johnson, of Marysville, owner.

Bessie Mine (Quartz).—This mine is 1½ miles W. of Inskip, in Sec. 29, T. 26 N., R. 8 E. The claim contains 40 acres and has three veins, distinguished as the decomposed (No. 1), the sulphuret (No. 2), and the ribbon ledge (No. 3), all on an E. and W. course, with a slight dip to the S. No. 1 has an average width of 3 ft.; No. 2, from 1½ to 2 ft., and No. 3, from 4 in. to 1 ft. The veins have all been prospected through tunnels; they are about 300 ft. apart, in a granitic formation. The tunnels are, respectively, 70, 100, and 40 ft. in length. T. Salisbury et al., of Inskip P. O., owners.

Butte King and Butte Queen Consolidated (Drift).—This is 8½ miles E. of the Chaparral House, in Sec. 20, T. 25 N., R. 5 E. The claims contain 2,150 ft. on the course of the channel by 1,000 ft. wide. For the present that part of the mine constituting the Butte King has been practically abandoned. The lava and pipe-clay capping is 150 ft. deep and about 1,000 ft. wide, while the channel beneath averages 5 ft. in thickness and 200 ft. in width. The gravel carries gold throughout, largely on the 5 ft. near the bedrock and toward the center and east rim; the west rim, where exposed, being apparently barren. The bedrock is granitic in part and partly quartzose schist. The present work will open the east of the channel on the Butte Queen ground. The tunnel has been run 469 ft. to the inside of the west rim, thence starting across and partly with the course of the channel 300 ft. A water-blast furnishes ventilation through a 2 in. air pipe. The elevation above the sea at mouth of tunnel is 6,225 ft. See our Xth Report, p. 145. Butte King and Butte Queen Consolidated Mining Company, owners; J. W. Woods, of Chaparral, Superintendent.

Butte Belle Mine (Drift).—This claim is 2½ miles S.W. of Lovelocks, in Sec. 3, T. 23 N., R. 3 E., in Forks of the Butte Mining District. A bedrock tunnel is being run in the serpentine N.W. 590 feet, to intersect a channel coursing N. 10° W. along Big Butte Creek. The breast of the tunnel is supposed to be about 40 ft. from the channel rim. The ground is worth $7 per foot to drift and timber. The claim embraces 159 acres of well-timbered ground and has a large and well-defined quartz vein running across it, on which gold prospects have been obtained. C. H. Ford, room 5, Crocker Building, San Francisco, owner.

Butte Creek Mine (Quartz).—This is 1 mile N.W. of Nimshew, on Big Butte Creek, in T. 23 N., R. 4 E. The property embraces 1,300 by 600 ft., through which an 18 to 30 in. quartz vein runs with a N.W. strike and a dip 45° E. There is a slate foot-wall and a limestone hanging-

wall. Two tunnels, about 70 ft. apart, have been run on the vein 160 and 80 ft., respectively, and this block of ground has been stoped; a second pay-shoot beyond has not yet been worked. A 10-stamp water-power mill, with 750 lb. stamps, reduces the ore, making 95 to 104 drops per minute. This mill is built at the upper level, and a water-hoist, using a 4 ft. Pelton wheel, conveys the rock to the upper level, from whence it is run to the mill. A 4 ft. Pelton wheel furnishes the power for the mill and a 10 in. wheel of the same pattern runs the two Frue concentrators. The mill is idle, as the tunnels are being pushed ahead. T. O. Carter, Big Butte Creek P. O., Nimshew, owner.

Buzzard Mine (Quartz).—This is 3 miles W. of Inskip, T. 25 N., R. 4 E., in Nimshew District. The claim is 3,000 by 600 ft., through which a quartz veinlet of extreme richness, often only 3 in. wide, strikes, with a N.E. course and S. dip. After extracting the quartz it is panned over and the tailings worked in an arrastra. Three tunnels, about 30 ft. distant, run into the hill; the two upper ones, 80 and 200 ft. long, and connected through an upraise, follow the vein. The third and lowest is a cross-cut 300 ft. in length, that has not yet cut the vein. The ore is sledded down hill to an arrastra 8 ft. wide, run by a 9 ft. undershot wheel, taking water from the Cherokee ditch, at a cost of 5 cents per inch. The arrastra makes from 14 to 16 revolutions per minute. T. Salisbury et al., of Inskip, owners.

Catskill Mine (Drift).—This mine is 1 mile N.W. of Bangor, in T. 25 N., R. 5 E. The claim employs 40 men when running, but is at present temporarily closed down. It contains 40 acres of ground, through which the same channel runs that is being worked by the Bangor Mine; about 1,600 ft. of the channel being estimated as within their lines, of which 600 ft. have been worked through a 210 ft. shaft, which reaches down to the bedrock. The gravel is from 12 to 14 ft. thick in places. Catskill Gravel Mining Company, owners; E. E. Meek, of Marysville, Secretary.

Coleman & Paxton Mine (Quartz).—This claim is located on Jordan Hill, 2 miles E. of the town of Paradise. W. T. Coleman, of San Francisco, owner.

Cole Mine (Drift).—See Xth Report, p. 144.

Defiance Mine (Quartz).—This mine is 9 miles N. of Oroville and 1 mile N. of Oregon City. There are two parallel veins, with slate and porphyry walls. There is a 90 ft. shaft on the vein. The quartz carries very few sulphurets. A. Ekman, of Oroville, owner.

Denver and Rio Grande Consolidated Mine (Quartz).—This mine is 3 miles W. of Forbestown. It has developed beyond a "prospect," on which a shaft is being sunk. — Price, of Forbestown, owner.

Dog Hill Mine (Drift).—This claim is 2 miles W. of Chaparral House, on the Magalia Ridge. It lies in T. 24 N., R. 5 E., and comprises 40 acres of ground, through which a gravel channel is supposed to run N.E. and S.W., and to cut which the company are driving a tunnel, at present 130 ft. long; 20 ft. farther they contemplate sinking, as they are too high, having struck lava after cutting through the rim. This ridge lies between the west branch of Feather River and the main branch of Butte Creek. Wetherbee et al., of Chaparral House, owners.

Dutch Ravine Mine (Quartz).—This is a prospect being developed 3 miles S. of Hurleton. A shaft has been sunk 135 ft.; the first 50 ft. vertical, the remainder on incline of 45°. The vein has a N. and S.

course, with a W. dip, and is from 2 to 5 ft. wide, between a slate hanging- and trap foot-wall. H. Stowe, of Forbestown, owner.

Gold Bank Mine (Quartz).—This property was described in our Xth and XIth Reports, pp. 125 and 162. The present ore supplies come from the stope on No. 2 drain tunnel level, No. 1 level E., and No. 3 level, on foot-wall side, W. On the No. 1 level E. the stope is 300 ft. long and the vein is 8 ft. wide. Two pumps are in the mine: an 8 in. plunger on the No. 2 level, and a 6 in. bucket pump on the No. 3 level, running with 5 ft. stroke. Motive power is water applied on six wheels under 150 ft. pressure. The crushing capacity has been increased by the addition of 20 stamps, or 40 stamps in all, with 16 Frue concentrators. The stamps are run from 90 to 100 drops per minute on a 7 in. drop, with about the same discharge, using narrow mortars. Both shoes and dies are steel, with a life only twice as long as good iron ones. No. 8 diagonal slot screens are used, which, when worn out, are used up in the chlorination works. Each stamp crushes 2½ tons in twenty-four hours. The pulp from the battery passes over an outside plate and 17 ft. of apron and sluice plates, set on a slope of 3 in. to the foot; also through sand-boxes and distributors before reaching the concentrators, which are producing 8 tons of sulphurets per week. The ore is passed through a No. 2 Gates crusher before reaching the mill, which is about 150 yds. distant from the hoisting works. The ore-bins have a capacity of 1,500 tons. The canvas tables below the concentrators are 60 ft. long, the sections being 22 in. wide. Settling-boxes are beyond, the material from which is chlorinated separately.

The chlorination plant handles 3 tons per day, making two charges. The furnace is a three-step reverberatory, with ten alternating doors. At the conclusion of the roasting proper, 5 lbs. of salt are introduced through each door on the ore, which is piled and remains heated for two hours before removing to the cooling floor. After cooling, 1½ tons are placed in an iron revolving barrel and mixed with 25 lbs. of sulphuric acid and 50 lbs. of chloride of lime, and water. The barrel is then closed and makes 7½ revolutions per minute for twelve hours. At the end of this the barrel is run on a track over the leaching-out vat, into which the charge is emptied.

The gold is leached with hot water, then "hypo" solution added without removing the charge, for the extraction of silver; and finally the copper precipitated as cement copper. The sulphurets, of which there are from 2 to 3 per cent in the ore, yield about $40 per ton in silver. The concentrates give an average yield of about $60 per ton. The ore can be mined and milled for $2 25 per ton, exclusive of the chlorination. The ores from this mine produce a peculiar coating of a hard, blackish-brown substance over the apron plates, which adheres like plating and does not appear to be readily affected by acids. This may be a combination of selenium, arsenic, and mercury, or arsenic, sulphur, and mercury. The entire plant is lighted by electricity, and 78 men are employed. W. W. Stow, of San Francisco, owner.

Golden Banner Mine (Quartz).—It is situated 5 miles N. from Oroville, and has lately passed into the hands of a new company, who are erecting an extensive working plant. See our XIth Report, p. 153. F. McLaughlin, of Oroville, owner.

Golden Feather Channel Company (*Limited*) (Placer).—Up to date 600 ft. of the lower end of the channel have been worked; also a stretch

immediately below the permanent dam. Stripping off the debris covering the unworked portion was being actively prosecuted in October, 1893. The flume for washing is 550 ft. long and 2 ft. wide, with a grade of 1¼ in. to the foot, and lined with 8 in. blocks. The tailings are elevated 60 ft. out of the bottom of the channel through a 21 in. pipe with a "hydraulic elevator." Fifty men work day and night, aided by electric lights. Fully illustrated in our XIth Report, p. 150. Golden Feather Channel Company, owners; F. McLaughlin, of Oroville, Manager.

Golden Gate Alluvial Syndicate Company (Limited) (Placer).—See our IXth and XIth Reports, pp. 271 and 152. Golden Gate Alluvial Syndicate Company (Ltd.), owners; W. G. Sanborn, of Oroville, Superintendent.

Golden Queen Mine (Quartz).—One half mile north of Forbestown. See our Xth and XIth Reports, pp. 120 and 162. At present 15 men are employed. C. Nickerson et al., of Oroville, owners.

Golden Summit Mine (Quartz).—This property is in T. 25 N., R. 5 E., Concow township, 10 miles E. of Chaparral House, and lies both in Butte and Plumas counties. It contains 5,000 by 100 ft.; the vein is 9 ft. wide, courses N.E. and dips W. At a distance of 100 ft. the tunnel cuts the ledge, on which it turns and continues for several hundred feet. An upraise connects the tunnel with the surface. The quartz is of ribbon texture and carries some sulphurets. A 10-stamp mill, supplied with Frue vanners, is being erected. Hon. Geo. C. Perkins, of Oakland, owner.

Golden Thread Mine (Quartz).—This property is on Secret Creek, 2 miles N.W. from Inskip, and comprises 1,500 by 600 ft., through which a veinlet 2 in. wide runs N. and S. and dips W.; the wall rocks are decomposed. A tunnel has been run 60 ft. on the vein, which has been stoped to the surface. Two 8 ft. arrastras with cog gearing are run by a 14 ft. overshot wheel with free water from Secret Creek. The gold is quite coarse. The property is worked by 3 men. G. W. Leeper, of Inskip, owner.

Gregory Mine (Drift).—This property is situated 9 miles E. from Chaparral House, in T. 25 N., R. 5 E., and is on the same gravel channel as the Butte King and Butte Queen to the south. The working tunnel has been run near the division line, and cuts through the rim rock 530 ft. from the mouth; here a shaft was sunk on the pitch of the rim rock 12 ft. deep, and a drift run across the channel 200 ft., where the breast shows the rim to be rising. The gravel averages 5 ft. in thickness, with a pipe-clay and lava capping. The gravel and water are hoisted by windlass, and the ventilating fan is run by hand-power. J. B. Dogle, of Chaparral House, owner.

Index Mine (Drift).—See Xth Report, p. 138.

Inskip Mine (Quartz).—This property is half a mile S.W. from Inskip, in Sec. 29, T. 25 N., R. 4 E. The claim of 1,500 by 600 ft. has two nearly parallel veins, with a N.E. course and a S. dip; they are about 20 ft. apart. No. 1 vein is from 6 in. to 3 ft. wide; the other about 2½ ft. A drift has been run between and parallel with the veins a distance of 100 ft., with intention to cross-cut to both veins; from this level there are 125 ft. of backs. The ore is hand-sorted and the better quality hauled to an 8 ft. arrastra run by a 16 ft. overshot waterwheel, the Cherokee Water Company's ditch furnishing 20 in. of water at a cost of $10 per month. Thomas McVeigh, of Inskip, owner.

John Dix Mine (Drift).—This property is 6 miles N. of Lovelock station, on the North Fork of Big Butte. The property comprises 200 acres, and after lying idle for a long time, is having a hoisting and pumping plant put in shape to reopen it. The old incline tunnel, which is being put in shape, was started in gravel on a slope of 2 ft. in 12 for a distance of 500 ft. The total width of the channel is 500 ft., 200 ft. of which constituted the pay streak. Four out of every five carloads taken from the channel are bowlders. The tunnel is extremely small; 4 ft. on bottom, 3 ft. on top, and using 6 ft. posts. The car contains only 18 cu. ft. The course of the channel is S.W., and it is supposed that the channel holds this course all the way down the ridge that lies between Oroville and Chico, no spot having been discovered where it breaks out. Bank of Chico, Chico, owner.

Jones Bros. and Reese Mine (Drift).—This property is 10 miles E. of Chaparral House, in Sec. 29, T. 25 N., R. 5 E. It is a southerly continuation of the Butte King and Butte Queen, and in this claim the channel breaks out. Its south continuation between this point and the Snow Diggings on the opposite side of the bank of the West Fork of Feather River has been entirely eroded. The elevation above the sea of the bedrock here is 6,140 ft. The main tunnel starts on the gravel near the west rim and runs in about 450 ft., and is connected by a cross-drift with an old tunnel run on the east rim, securing good ventilation. The gravel is breasted out 35 ft. wide and 5 ft. high, using posts and caps for timbering. The bedrock is partly syenite and partly a quartzose slate. When crevices are found the yield is quite large. The narrower the channel the richer the gravel, the gold being all coarse. The gravel is very clayey, but more so on the east than on the west rim; it also contains a large amount of quartz. The grade of the bedrock is irregular, making in one place a fall of 4 ft., below which point the ground was extremely rich. About 20 carloads of gravel are washed at a time with the 3 in. of water that drain from the tunnel, passing through 120 ft. of flume provided with cross and slat riffles. The upper cross riffles are cleaned twice per week, the remainder once a month. The mine is only run during the summer months. Jones Bros. et al., of Chaparral House, owners.

Keystone (Reasner) Mine (Quartz).—This property was described in our Xth Report, p. 127, and is situated 1 mile W. of Forbestown. A shaft has been sunk. The formation is syenite. D. Reasner, of Forbestown, owner.

Kickapoo Placer Mine (Drift).—This mine, formerly hydraulicked, is 3¼ miles N.W. of Strawberry Valley, on the Mooreville Ridge, T. 20 N., R. 7 E. The property consists of two patented claims, the Kickapoo and the Burgstresser placers, containing 48 and 60¾ acres, respectively. The bank is 150 ft. deep, including a 20 ft. lava capping, 10 ft. of a sand streak, and the 120 ft. of gravel. Next to the granite bedrock the gravel contains many large bowlders. A 200 ft. tunnel has been run on the bedrock, and drifts run out to both sides for a distance of from 40 to 50 ft. without reaching either rim; the course of the channel is E. and W. The gravel is gray, somewhat cemented, and prospects throughout the whole depth, but is best on the lower 6 ft., some parts having yielded from 25 cents to $1 per pan several feet from bedrock. It will be breasted down from 6 to 8 ft. deep. The gold is not coarse, and is .940 fine. The

water supply for three or four months is taken from Rock and French creeks. J. H. Drake et al., of Strawberry Valley, Yuba County, owners.

Lost Treasure Mine (Quartz).—This property is on Dutch Gulch, situated ¾ of a mile N. of Inskip, in Sec. 28, T. 26 N., R. 4 E. It contains 1,500 by 600 ft., and carries quartz stringers, each about 12 in. wide, striking N.E., on which a tunnel has been driven 150 ft. The wall rocks are decomposed altered syenite. The gold occurs in pockets. J. Hedges et al., of Chaparral House, owners.

Lucky Bob Mine (Quartz).—This property is situated on Feather River, 4 miles N. of Oroville. The vein crops out near the banks of the American River, and courses a little W. of N., dipping 55° W. It is about 2 ft. wide, between greenstone walls, and occasionally a little slate. A tunnel has been driven on the vein 550 ft. A crew of 60 men are working. Col. F. McLaughlin, of Oroville, owner.

Lucretia Mine (Drift).—See Perschbaker.

Magalia Consolidated (Mineral Slide) Mine (Drift).—This property has been described in our VIIIth and Xth Reports, pp. 117 and 145. The claim embraces 400 acres of patented ground. Several tunnels have been driven under the lava capping, reaching a distance of 1,300 ft., and disclosing an extremely wide body of gravel. No breasting was being done, the gravel drifts being run ahead 3½ ft. high. In the main gangways the timbers consist of 6½ ft. posts, 3⅝ ft. caps in the clear, and 5½ ft. spread. The pay extends throughout the gravel, right up to the lava capping. The bedrock is partly slate, partly sandstone, the latter fossiliferous. To work the gravel successfully a deeper bedrock tunnel is required. The present cost of extracting a carload of gravel is 40 cents. Ten carloads (100 lbs. each) are extracted per man; the total width of the gravel is half a mile. N. D. Rideout et al., of Oroville, owners.

Mammoth Gold Mine (Quartz).—This property is 1¼ miles N.W. from Inskip, in Sec. 30, T. 25 N., R. 4 E., and consists of a full quartz claim, 1,500 by 600 ft. The vein is 10 in. wide, and courses E. and W., with vertical walls of porphyry and granite. A shaft 4 by 6 ft., sunk to a depth of 20 ft., has been drifted from about the same distance, and this block of ground stoped to the surface. Not being worked at present. Messrs. Leeper & Cory, of Inskip, owners.

Mascot Mine (Quartz).—This property is situated 6 miles from Oroville. The claim consists of 4,500 by 600 ft., with a N. and S. vein 1 to 8 ft. wide, dipping 60° E., between greenstone and porphyry, the latter being the hanging-wall. A cross-cut tunnel 165 ft. long reaches the vein, which has been drifted on 26 ft. N. and 80 ft. S., giving 280 ft. of backs. A 10-stamp water-power mill, with 1,000 lb. stamps, and two Woodbury concentrators, belong to the property. The mill uses No. 35 punched screens, and has a 12 ft. apron set on a grade of 1½ in. to the foot. Four men are working the mine; the mill is not running. Mascot Mining Company, owners; A. Gabriel, of Woodland, President.

Mineral Slide Mine (Drift).—See Magalia.

Oro Fino Mine (Drift).—This property was described in our VIIIth and XIth Reports, pp. 118 and 160. There are 80 acres in the property. The channel, with S.E. course, is lava-capped; the bedrock, serpentine and slate; has an altitude of 2,340 ft. The present working tunnel started on an outbreak of gravel, and was run to the S.E. a distance of 750 ft., where a smaller channel or feeder ran into it. The main gangway is extended 3,000 ft., and shows the course of the channel at that

point to be a horseshoe bend. The gangway drifts are carried 5 ft. high, with about 40 ft. wide breasts; the timbering in the latter are single posts and caps. The main gangway has 6 ft. posts, with 5 ft. spread at the bottom. The gold is smooth, well-washed, and sells for $17 75 per ounce. L. Cohen, of Magalia, owner.

Pactolian Mine (Quartz).—This property is 2 miles N. of Hurleton, T. 19 N., R. 5 E., and shows a vein from 2 to 8 ft. wide. L. Jacobs et al., of Oroville, owners.

Palace Mine (Drift).—This 80-acre claim is 1½ miles W. of Lovelock, on Big Butte Creek, T. 25 N., R. 3 E. The channel is supposed to have an E. and W. course. The former tunnels being too high, a new bedrock tunnel has been started in the greenstone, and is in 30 ft. at present. P. Reardon, of Lovelock, owner.

Palo Alto Mine (Quartz).—This property has been described in our Xth and XIth Reports, pp. 129 and 164. The 3 ft. vein courses N. and S., dips about 75° E. Palo Alto Mining Company, of Merrimac, owners.

Parry (Alki) Mine (Drift).—See our Xth Report, p. 141. It is situated 2 miles N.E. of Magalia. For seven years the owner, with very limited means, has been sinking an incline on the west branch of Feather River, to tap the deep channel that is supposed to follow down the Magalia ridge. The twisting off of the 3½ in. steel crank shaft caused the mine to fill up with water in thirty-six hours, shutting down the works temporarily. The vertical depth reached is about 250 ft. G. Parry, of Magalia, owner.

Perschbaker (Lucretia) Mine (Drift).—This property was mentioned in our VIIIth Report, p. 110, and is situated on Little Butte Creek, 2½ miles N. from Magalia, in Sec. 13, T. 23 N., R. 3 E. The channel is only from 4 to 20 ft. wide, with steep grade. It is supposed to be a branch, and to join the deep channel under the Magalia ridge. It makes considerable water, and ten pumps are required to control it, four boilers 4 by 16 ft. being required. Two compressors are run by water power, with 110 ft. head, operating on two 5 ft. Knight wheels. From mouth of incline to bottom of the works is 250 ft. perpendicular, and the present bedrock is about 200 ft. below the level of Butte Creek. The work has been down the channel; the general grade is 12 ft. in 100. The gold is very coarse, and in places almost covers the bedrock; it is worth from $18 75 to $19 per ounce. N. D. Rideout, of Marysville, Yuba County, owner.

Phœnix Gold Mine (Quartz).—This property is 3 miles S. of Hurleton and 15 miles from Oroville, in Sec. 28, T. 19 N., R. 5 E. It embraces three claims (4,500 by 600 ft.), with 600 acres of timber land. The vein, 2 to 8 ft. wide, has a N. and S. course between decomposed wall rocks, well mineralized, standing nearly vertical. The main working shaft is 105 ft. deep. The hoist is a patent horse-whim. Short drifts are run from the shaft N. 33 ft. and S. 50 ft.; some stoping has been done. About 1 mile from the mine is the mill, a Bryan roller, with a Stanford self-feeder and Dodge rockbreaker. The mill makes 18 to 20 revolutions per minute, crushing 12 tons in twenty-four hours, and using a No. 40 diagonal slot cut screen. An apron 5 by 15 ft. carries the pulp to a Johnston concentrator; 80 per cent of the amalgam is obtained inside the mill. Below the concentrator is a canvas plant 40 ft. long, and a riffled sluice having a grade of 1 ft. in 6. The quartz has a ribbon structure and carries 3 per cent of iron and copper sulphurets.

Ore hauling costs 60 cents per ton. The mine is ventilated by means of a stove placed at collar of the shaft. J. L. Gibson et al., of Hurleton, owners.

Porphyry Point Mine (Quartz).—See our XIth Report, p. 161.

Porphyry Point Mine (Drift).—It is 3½ miles N. of Magalia, and contains 30 acres, through which a channel is supposed to run N.E. and S.W. A bedrock tunnel 75 ft. in length was run in porphyry, then an incline for 90 ft. that reached a perpendicular depth of 22 ft. The gravel has not been reached, but sediment is showing in the face. See our XIth Report, p. 169. R. Shipley et al., of Magalia, owners.

Rainbow Mine (Quartz).—This property was described in our Xth and XIth Reports, pp. 131 and 158, and is situated on Jordan Hill, 4 miles N.W. of Yankee Hill. Captain Griffith, of San Francisco, owner.

Republican Mine (Drift).—This property is situated 4 miles N.W. from Lovelock, on "Forks of the Butte," in T. 24 N., R. 3 E., and contains 140 acres. Course of the channel is slightly S. of E., and 1,200 ft. of it has been worked. The gravel drifts have been run at right angles from the main gangway 50 ft. in gravel without touching the rim rock. The gravel is worked 4 ft. deep with 25 ft. breasts. The bedrock is slate and granite, the channel running part way on the contact. There are two qualities of gravel: the red and the regular blue. The gold is smooth-washed; a breaster can take out 6 cars per day; the best pay is on the bedrock, 1 ft. of which is picked up. An old tunnel 200 ft. long is used as a reservoir, and the washing is done once a day through 160 ft. of sluices, using Hungarian and slat riffles; the head box is cleaned once a week, the remainder once a month. About 400 ft. from daylight in the tunnel the bedrock makes a 4 ft. raise. A belt of slate filled with quartz seams passing through the country rock would seem to justify its working, as where the outlet cut was made through it pieces of good-paying quartz were picked up, apparently from a pocket. P. N. Woods, of Lovelock, owner.

Scott's Bar Mine (Placer).—This property is 3 miles W. of Lovelock, on Big Butte Creek, in T. 24 N., R. 3 E. The property comprises 1,100 ft. along Butte Creek, and is 790 ft. wide. The pay ground is in a bar of Big Butte Creek running under the present bank, and a tunnel 30 ft. deep is run into it. The water of the creek is brought down through 2½ miles of ditch and affords 120 ft. pressure. The flume is 200 ft. long, 2 ft. wide, paved with blocks and pole riffles. The upper box is cleaned once a week, the remainder once a month; 200 carloads can be washed per day; 60 per cent of the washed material is bowlders. J. Leechman et al., of San Francisco, owners.

Shakespeare Mine (Quartz).—This property was described in our Xth and XIth Reports, pp. 128 and 163, and is situated in Forbestown. It gives employment to 50 men, 30 being in the mine. The 4 ft. vein, which is very strong, crops out for several hundred feet with an N. and S. course and a dip of about 80° W. Since being under the control of the present management, the mine has been fully equipped with steam hoisting works, a 30-stamp mill, and a chlorination plant. From the incline shaft to the mill is a loop incline tramway, the descent of the full car bringing the empty one up. The formation is syenite and greenstone, the former projecting into the latter between the mill and hoist. The general character of the quartz is similar to that of the Gold Bank Mine, but the character of the sulphurets appears more diversified.

The 30 stamps, of 1,000 lbs. each, drop 100 times per minute. There are battery plates, but no aprons; only sluice plates. There are also 12 Frue concentrators and a chlorination plant, using direct generation of chlorine gas. No silver or copper is saved, although the works are prepared to save silver. The capacity is for 5 tons of concentrates per day, but they only work 3 tons per twenty-four hours at present. The reverberatory furnace has working doors on one side only, the interspaces between the doors being beveled off on the inside. The new shaft is down 250 ft. and drifting has commenced. Col. A. Hayward et al., of San Francisco, lessees; — Nickerson, Superintendent.

Standard Gold and Silver Mining Company (Quartz).—This property is at Oregon City, 8 miles N.E. of Oroville; it is an old mine that is being reopened. The present claim includes 4,500 by 600 ft. The 2 ft. vein courses N.W. and S.E. and dips about 45° E; it has greenstone walls. The quartz carries about 1 per cent iron sulphurets. The present work includes an incline shaft 250 ft. deep, on the pitch of the vein, with N. and S. drifts at the 100 and 200 ft. levels. From the upper drift stopes connect with the surface. The power is supplied by a 10 horse-power steam engine; a No. 6 Knowles pump controls the water, and a 4 ft. Bryan roller mill crushes the ore. The works employ 26 men. E. T. Jewell, of San Francisco, Secretary.

Turner Mine (Drift).—This property is 1 mile E. of Bangor, in T. 25 N., R. 5 E. The claim controls 1,000 ft. on the channel, which is N.W. and S.E., and has a width of about 40 ft. The pay gravel is 8 ft. deep, but a capping of barren gravel reaches the surface. There are two 50 ft. shafts on opposite sides of the channel, and drifts are being run from both across the channel. The bedrock is slate. Timbers used are posts 6 ft., caps 3⅛ ft. in the clear, with 5 ft. spread. A 6 in. jackhead pump, run by steam, consumes 1½ cords of wood per twenty-four hours, at an expense of $2 per cord. The boiler is 26 horse-power. The grade of the channel is 3 ft. in 100. An arrastra, tank, and flume are being built. Water is obtained from the Forbestown ditch, 7 in. being used, costing 10 cents per inch. The gold is flaky, and worth $18 50 per ounce. Gravel is tight, but not cemented. Turner Drift Mining Company, of Marysville, owners.

Wood's Mine (Drift).—See Xth Report, p. 144.

CALAVERAS COUNTY.

This county boasts the largest producing gold mine in the State, and there are many properties which promise, with complete equipment, to become as great as any of those now operating. Several old mines have recently been reopened near Murphys, and the Gwin Mine, after years of idleness, is again in operation. Besides the quartz industry, there are 50 miles of the ancient gravel channels remaining unworked.

Adelaide Mine (Quartz).—It is on the "Mother Lode," at Robinson's Ferry. See our Xth and XIth Reports, pp. 57 and 169. It was worked in a small way during 1893. Harvey Woods, of Robinson's Ferry, owner.

Angels Mine (Quartz).—It is N. of Angels. Described in our VIIIth and Xth Reports, pp. 141 and 150. J. V. Coleman, of San Francisco, owner.

Balaklava Mine (Drift).—It is 2 miles S.E. of Vallecito, and is part of what is called the Cataract channel; this channel extends southeastward into Tuolumne County. Luke Sanguinnetti, of Vallecito, owner.

Bald Hill Mine (Quartz).—See Graham.

Banner Mine (Quartz).—See Mayflower.

Beatrice Mine (Quartz).—It is near the Buckhorn, and is idle. W. S. Edwards, of Murphys, Superintendent.

Beatrice Mine (Quartz).—See Mayflower.

Belle Mine (Quartz).—It is on the southeastern slope of Carson Hill, near the Stanislaus River, and is a new property in course of development. A cross-cut tunnel 210 ft. in length intersects two veins 25 and 15 ft. wide and 75 ft. apart. A third vein cropping on the surface will probably be cut by this tunnel a short distance farther in. Drifts have been run 70 ft. N. on the first vein, and 200 ft. S. on the second.

Birney Mine (Quartz).—This is a new "prospect" on the Birney ranch, 1½ miles N.E. from Angels. The four owners of the mine are developing it. A shaft has been sunk 110 ft. There are eleven veins of quartz known on the surface, and two "blind veins" have been discovered beneath. These veins all occur within a zone 200 ft. wide. Good prospects are obtained on several of these veins. In sinking on two veins of 18 in. and 24 in. they have widened at the 100 ft. level to 4 ft. each of pay rock (quartz and schist). These veins all occur in altered diabase (chloritic and talcose schist), and contain from 3 to 4 per cent auriferous iron sulphurets. The geological features of this mine thus far greatly resemble those of the Utica Mine, at Angels Camp. T. L. Birney & Co., of Angels, owners.

Blair Consolidated Mine (Quartz).—See Smith's Flat and our XIth Report, p. 172. A new shaft was being sunk in 1893. James Schmedake, of Angels, owner.

Blazing Star Mine (Quartz).—This and the adjoining property, *The Water Lily*, owned by the same company, is 1½ miles E. of West Point. Described in our VIIIth Report, p. 414. Since then the workings have been carried down to the 450 ft. level. The concentrates were formerly sent away, but will now be treated at the mine, where custom work will also be taken. C. J. Moore, of West Point, Superintendent.

Boston Mine (Quartz).—This is 2½ miles N.E. of Mokelumne Hill, on Indian Creek. Patented under the name of *Esperanza*. The vein or zone of gold-bearing quartz occurs on a much splintered and crushed dike of diorite of dark greenish-gray color. The zone of fracture is 40 to 60 ft. wide. The quartz contains iron, lead, zinc, and copper sulphurets. It is without wall or well-defined limits. Interstratified or intermingled with the irregular masses of quartz are strips and bunches of chloritic and talcose schist, altered from the diorite country rock. A large amount of work has been done here. M. Davidson, of Mokelumne Hill, owner.

Bruner Mine (Quartz).—It is on the "Mother Lode," 2 miles S.E. of Angels. Referred to in our Xth and XIth Reports, pp. 59 and 174. F. Bruner, of Angels, owner.

Buckhorn Mine (Quartz).—It is 2 miles W. of Murphys. It is now being reopened after a long period of idleness. Two veins are exposed on the surface 140 ft. apart. A cross-cut tunnel 275 ft. long cuts one of them, exposing a fine banded vein 2 ft. in width. This vein is of the branching character common to many veins in slaty rocks. The formation here is mica schist and quartzite with dike rocks, one of which accompanies each vein. The mine has not been worked to any great

epth. It was worked for fourteen years in a desultory sort of way. '. R. Garnier, of Murphys, Superintendent.

Buckminster Mine (Drift).—See Uptograph.

Calaveras Mine (Quartz).—This is 5 miles N. of Murphys, on the ;heep Ranch road, and, after a long period of idleness, resumed opera- ions in January, 1894.

Calaveras Consolidated Mine (Quartz).—It is on the southern slope of Carson Hill, at Robinson's Ferry. See our Xth and XIth Reports, pp. 56 and 169. During the summer of 1893 a new vertical shaft was sunk, cutting at 230 ft. in depth a shoot of quartz. W. J. Scrutton, of Angels, Superintendent.

Canape Mine (Quartz).—This claim is 1 mile W. of the old town of Carson. It is a small prospect, but yields a high-grade quartz. Jos. Canape, of Carson, owner.

Carson Creek Mine (Quartz).—It is on lower Carson Creek, at its junction with the Stanislaus River. This property has been erroneously referred to in our XIth Report, p. 173, as the "Jones Mine." The formation is highly metamorphic rock of indefinite character, probably a much altered slaty or schistose diorite. The mine is opened by an incline shaft 250 ft. deep, and there is also a vertical shaft of 140 ft. There are 700 ft. of levels and drifts. On the 100 ft. level two cross-cuts were run, one 70 ft. and the other 90 ft., without finding a wall. The quartz carries 0.5 per cent of sulphurets, mostly iron and zinc. Some of the latter is extremely rich in silver and has been mistaken for hessite (silver telluride). Twenty stamps were added in 1893 to the twenty already in place. Tulloch concentrators, sixteen in number, are in use. A chlorination plant is in contemplation. The *Belle Mine* is under the same management. E. W. Roberts, of Angels, Superintendent.

Central Hill Mine (Drift).—This claim is half a mile W. of Murphys. A drain tunnel 3,000 ft. in length is being run from the vicinity of Douglas Flat, and was 1,600 ft. in in September, 1893. W. Thomas, of Douglas Flat, owner.

Champion Mine (Quartz).—It is 1½ miles west of West Point, and is 750 ft. deep, where the profitable ore shoot was exhausted, and work abandoned. The vein formed in a dike of diorite, having a strike nearly N. and S., and a dip of 35° to 65° W. The walls are very uneven, owing to pinches and swells in the dike mass. The outside country rock is hornblendic granite of even texture and light-gray color. The shaft was started on a small vein in the granite, which was quite rich; at a depth of 300 ft. the shaft entered a zone of chloritic and talcose schists (locally called serpentine and slate). A large lens-shaped mass of quartz was encountered at a greater depth, which reached diagonally from wall to wall, pitching S., and was followed downward 400 ft., and produced a large amount of bullion. A small quartz vein was found on both foot- and hanging-wall of the dike, but neither contained sufficient gold to pay. S. Rufino, of West Point, owner.

Chappellet Mine (Drift).—This claim is in Chile Gulch, 2 miles S.W. of Mokelumne Hill, and is on the Chile Gulch channel. A new hoist and mill were built in 1893, and are in successful operation. F. Chappellet, of Mokelumne Hill, owner.

Cook Mine (Quartz).—It is 1½ miles N.E. of Angels, and adjoins the Birney Mine. The vein, from 1 to 4 ft. wide, occurs in a light-gray dike

rock. The surface quartz is much disintegrated and stained with iron oxides, and is heavily sulphuretted. S. Cook, of Angels, owner.

Crown Point and Teirakoff Mines (Quartz).—These adjoining properties are on the north side of the South Fork of the Mokelumne River. 2½ miles N.W. of West Point. They are on the "Champion dike," and have similar geological features. In the Crown Point Mine a shoot of quartz was extracted, which occupied a position nearly midway between the walls of the dike and lying parallel with them. Work is now being prosecuted in the Teirakoff Mine in search of a similar deposit. Here occasional transitions between the normal crystalline diorite and completely altered schists may be found. Teirakoff Company, of West Point, owners; — Marchand, Superintendent.

Demorest Mine (Quartz).—It is 6½ miles S. from San Andreas, and has reached a depth of 107 ft. The vein is 5 to 7 ft. wide, and the quartz is dark blue and carrying 3 or 4 per cent of iron sulphurets. D. D. Demorest, of Altaville, owner.

Dodson & McQuaid Mine (Quartz).—It is a mile S.W. of Murphys. The vein is 18 in. wide, and the quartz is blue and banded, and carries iron and lead sulphurets. The formation is black slate. Dodson & McQuaid, of Murphys, owners.

Dora Mine (Quartz).—It is 3 miles N. of Murphys. A tunnel and other workings expose a vein 1 ft. in width, some of which is rich in gold. A 5-stamp mill is about completed. George Hengen, of Murphys, Superintendent.

Eclipse Mine (Quartz).—It is 1½ miles N.W. of Angels (see Smith's Flat). A new shaft was being sunk in 1893. T. E. Flagg, of Angels, owner.

Edna Mine (Quartz).—It is 3 miles N.W. of San Andreas. The developments consist of a shaft nearly 100 ft. deep, and a cross-cut of 35 ft. The cross-cut passes through a dike of granular, buff-colored, heavily mineralized rock, 36 ft. in width, which is gold-bearing from wall to wall, with the exception of 5 ft. of hard rock near the middle. Near the west wall several large masses of quartz containing gold have been found, but were not developed in 1893. J. S. White, of San Andreas, owner.

Esperanza Mine (Quartz).—See Boston.

Eureka Mine (Quartz).—This location is 1 mile N. of West Point. A new shaft is down 100 ft. The 5-stamp mill is a quarter of a mile distant, where it is run in connection with a sawmill; the waste of the sawmill supplying fuel for both. The vein, from 1 to 3 ft. wide, is a simple fissure in granite, and has sustained a curious cross fracturing. The quartz breaks freely from the walls, but there is no selvage or gouge. Joel Rowe, of West Point, owner.

Everlasting Mine (Quartz).—This patented claim is half a mile S. of San Andreas. See our Xth Report, p. 63. N. Seiffort, of San Andreas, owner.

Fellowcraft Mine (Quartz).—This is on the eastern outskirts of San Andreas, and is described in our Xth and XIth Reports, pp. 149 and 178. Herman Bode, of San Andreas, owner.

Finnigan Mine (Quartz).—It is on Carson Hill, and is being worked in a small way for pockets. Tarbut, Bickel & Co., of Angels, owners.

Gold Cliff Mine (Quartz).—This property is being operated as one of the Utica group, and is on one of the branches of the "Mother Lode,"

just W. of Angels. It has a somewhat unusual geological structure. See our Xth Report, pp. 60 and 150. Hayward, Lane & Co., of Angels, owners.

Gold Hill Mine (Quartz).—This is half a mile S.E. of Vallecito. The vein, having a N.E. course, is a fissure in diorite, and is accompanied by a dike of felsite. It is a "pocket" claim, and said to have produced largely. Johnson & Burnell, of Vallecito, owners.

Gold Hill Mine (Quartz).—This property is 1½ miles N.W. of Angels. See Smith's Flat and our Xth Report, p. 170. The surface portion of the mine is a labyrinth of cuts, trenches, and drifts, made in mining for rich pockets. There are over 2,500 ft. of shafts and levels, exclusive of the surface cuts. That portion of the mine which is below 100 ft. from the surface is now being developed in a systematic manner. S. V. Ryland, of Angels, owner.

Graham (Bald Hill) Mine (Quartz).—It is on one of the branches of the "Mother Lode," a mile south of Angels. See our Xth and XIth Reports, pp. 150 and 174. L. Graham, of Angels, owner.

Guadaloupe Mine (Quartz).—See Homestead.

Gwin Mine (Quartz).—It is on the "Mother Lode," 3 miles W. of Mokelumne Hill. This famous mine is completely described with sectional plates in our VIth Report, p. 30. It is now being reopened, and fine hoisting works, capable of lifting 3,000 ft., are being erected. Gwin Development Company, owners; F. F. Thomas, of Mokelumne Hill, Superintendent.

Hale Mine (Quartz).—This location is half a mile W. of Angels. See our Xth Report, pp. 60 and 147.

Hardy Mine (Quartz).—This is situated 1 mile S.E. of Angels. It consists of a broad zone of alternating magnesian schists and quartz veins of greatly varying size. Considerable work, mostly of a superficial character, has been done. Structurally, the mine is somewhat like the Utica. Considerable gold has been taken out in pockets. Two men make a living "pocket mining" on this claim, which should be operated in a larger way to secure the best results. Hardy & Osborne, of Angels, owners.

Hillary Mine (Quartz).—See Lone Star.

Holland Mine (Quartz).—It is 2 miles S. of San Andreas. At this mine a hoist and mill were erected to work a mass of talcose schist said to contain auriferous iron pyrite. All operations were suspended after a short trial. W. Holland, of San Andreas, owner.

Homestake Mine (Quartz).—This is in a small district 5 miles E. of Murphys. The settlement is called Collierville. The region is distinguished for the high-grade quartz, which occurs as lenses and veins in mica schist. Geologically it is similar to the mines about American Camp, on the opposite side of the Stanislaus River. The mines are on the "east lode." In the Homestake, which may be taken as a type of the entire group, there are two fissures nearly parallel, strike E. and W., and 3 to 8 ft. apart. The schistose rock between these crevices is much disturbed and crushed. The foot-wall is well defined, while the hanging-wall crevice is rarely well defined for any considerable distance. The quartz lies in a small vein on the foot-wall side of this crushed rock; branching and reticulated veinlets sometimes unite and form a solid mass up to 28 in. in width. It is claimed that at one point (inaccessible) the vein is 8 ft. wide. W. Collier, of Murphys, owner.

Homestead and Guadaloupe Mines (Quartz).—They are in the Glencoe District, 1¾ miles S.E. of Glencoe, which is largely granitic in character. The property was being reopened in the fall of 1893, after a long period of idleness. S. Tyson, of Glencoe, Superintendent.

Hudson Mine (Quartz).—It is on the western side of Central Hill, and half a mile N. of North Branch Post Office, 4 miles S.W. of San Andreas. The vein is 3 to 5 ft. wide, and dips to the S. A vertical shaft was sunk and was continued in the foot-wall, but no cross-cut was ever run to cut the vein. M. Angels, of San Andreas, owner.

Ilex Mine (Quartz).—It lies between Mokelumne Hill and West Point. See our VIIIth Report, p. 135. Idle.

Illinois Mine (Quartz).—It is 6 miles S. of San Andreas. See our Xth Report, p. 149. After a long period of idleness work was resumed late in 1893. Ben Thorne, of San Andreas, owner.

Iron Rock Mine (Quartz).—This is on the northern slope of Carson Hill. The name is derived from the occurrence of a vein of hematite in the fissure. It has been explored for pockets only. Richard Cohen, of Vallecito, owner.

Jones Mine (Quartz).—See Carson Creek.

Keltz Mine (Quartz).—It is 4 miles N.E. of West Point, and is in granite similar to the Eureka and Blazing Star mines. In operation in 1893. O. A. Peaseley, of West Point, Superintendent.

Kentucky House Mine (Quartz).—This is 2½ miles S. of San Andreas, on the Copperopolis road. It is a new prospect, and has a shaft 60 ft. deep. John Seiffort, of San Andreas, owner.

Lamphyre Mine (Quartz).—It is a short distance N. of the Moser Mine, and covered by an agricultural patent, although a promising prospect.

Lane and Tulloch Mine (Quartz).—See Matson.

Last Chance Mine (Quartz).—On the southeastern slope of Carson Hill. Adjoins the South Carolina. James Wood, of San Andreas, owner.

Lewis Mine (Quartz).—See Gold Hill.

Lone Star Mine (Quartz).—This property, which also includes the Reed & Hillary vein, is 2½ miles W. of West Point. It is the largest property being operated at present in this section. The veins, of which there are two important ones, are 50 to 140 ft. apart, strike a little E. of N., and dip generally to the W. The inclosing rock is hornblendic granite of normal type. The linear extent of the workings exceeds 7,000 ft. The bunches of quartz which constitute the vein occur as replacements in the granite, crushed between a series of fault planes, some of which are nearly perpendicular and parallel, and a second series which pitch to the W. at an angle of 15° to 40°. The ore shoots have a pitch to the N. at an angle of 30°. The sulphide minerals are iron, zinc, and lead; a large percentage of the iron pyrites (pyrrhotite) are magnetic, and seriously disturb the working of the magnetic needle. See our Xth Report, p. 152. Lone Star Mining Company, owners; M. Hurley, of San Francisco, President.

Louisa Mine (Quartz).—This is 3 miles W. of Murphys. A cross-cut tunnel 120 ft. long has been driven to the vein, and a drift 300 ft. long was run on the vein, when it encountered caved ground in an old shaft. The veins are small but rich. The fissures have a branching tendency. Granite dikes accompany all the veins. The formation is mica schist and quartzite. The dike rock at times appears to cut the quartz out entirely. Carley Bros., of Murphys, owners.

Matson (*Lane and Tulloch*) *Mine* (Quartz).—This is in the townsite of Angels, and is the south extension of the Gold Cliff. See our Xth and XIth Reports, pp. 59, 151, and 171. The property is being actively worked. The shaft is between 900 and 1,000 ft. deep, the greatest depth reached in this vicinity (the collar of the shaft is nearly 200 ft. lower than that of the Utica-Stickles). The rock extracted in prospecting keeps 20 stamps in constant operation. The "reserves" are very extensive. The reported expense of mining and milling is but little over $1 per ton. This mine uses the waste water from the Utica hoists and mill. A 32 ft. overshot wheel supplies power to the mill, and a hurdy wheel runs the hoist. Two Frue and two Tulloch concentrators save the coarser sulphurets, no attempt being made to save the slimes. Hayward & Lane, of Angels, owners.

Mayflower (*Banner*) *Mine* (Quartz).—It is 1½ miles W. of Murphys. After a long idleness this mine is being reopened. There are two veins, one of which is called the "Mayflower" and the other the "Banner." The formation is mica schist and quartzite. The veins strike nearly E. and W. and dip 85° N. They conform to the strike and dip of the exclosing rocks. The Mayflower vein is 4 ft. wide. There are several smaller veins lying back in the foot-wall, which may join the main fissure in depth. Two shafts are being sunk on the Mayflower vein, 600 ft. apart, and a level is being run to connect them, 118 ft. from the surface in the deeper shaft. A cross-cut is also being run on the level to cut the Banner ledge, which lies north of the Mayflower. The *Total Wreck* and *Beatrice* claims also lie north of the Mayflower. An old tunnel, 400 ft. long, running across a portion of the Beatrice ground, has been reopened and is being driven in through the Total Wreck, and will be continued to a connection with the workings on the Banner and Mayflower veins. New hoists have been built and active mining operations on a large scale inaugurated. W. S. Edwards, of Murphys, Superintendent.

McQuaid Mine (Quartz).—See Dodson.

Melone's Mine (Quartz).—This claim is on the "Mother Lode," on the southern slope of Carson Hill, near Robinson's Ferry. After producing a large amount of gold from pockets, work was abandoned and the mine has now lain idle for years. It produced several varieties of *telluride*, among them being the rare melonite (telluride of nickel). Geo. W. Grayson, of San Francisco, owner.

Morgan Mine (Quartz).—It is on the "Mother Lode," at the summit of Carson Hill. See our IXth and Xth Reports, pp. 37 and 57. Jas. G. Fair & Co., of San Francisco, owners.

Moser Mine (Quartz).—This is situated on Spring Gulch, within a mile of Mokelumne Hill. The workings are immediately under a portion of the Tunnel Ridge gravel channel, and all above the level of the tunnel. Two veins, 4 or 5 ft. apart, and ranging from a few inches to 6 ft. in width, are being mined. The country rock is slate. A dike accompanies the vein, and it is said that on the contact the rock is richer. The sulphurets (2 to 3 per cent) are iron, lead, and zinc. The quartz is crushed in a new 10-stamp mill, provided with concentrators. W. T. Harris & Co., of Mokelumne Hill, owners.

Moser Mine (Hydraulic).—This claim, on Tunnel Ridge channel, is on the east side of Spring Gulch, near the Moser Quartz Mine. W. T. Harris & Co., of Mokelumne Hill, owners.

Moyle Mine (Drift).—It is 2 miles S.E. of Vallecito, on the Cataract channel. J. Moyle, of Vallecito, owner.

New York Mine (Quartz).—This is 2 miles N.E. of Railroad Flat. The vein is from 8 to 12 in. in width. It contains iron and copper sulphurets and occasionally galena. It has a small hoist and mill. James Prentice, of Stockton, owner.

Norfolk Mine (Drift).—This claim is a mile S.E. of Murphys. The channel is much disturbed, portions of it standing vertically, and all parts of the deposit standing at a high angle, and are much broken. The extent of the workings is too limited to discover the cause of this disturbance, but it appears to be partly due to the intrusion of igneous material and faulting of the rocks. The mine is worked through an incline shaft 200 ft. deep, and has a well-arranged hoisting and sluicing plant. T. B. Morse, of Murphys, Superintendent.

North Trojan Mine (Quartz).—See Trojan.

Oro y Plata Mine (Quartz).—This is located on the hillside just N.W. of Murphys. It is equipped with a complete hoisting and milling plant, but is now idle. Frank Morse, of Murphys, Superintendent.

Particelli Mine (Quartz).—This is a new "prospect," 3 miles W. of Mokelumne Hill. A small force of men is employed. Colonel Robinson, of Mokelumne Hill, Superintendent.

Phillips Mine (Hydraulic).—This claim is 3 miles N.E. of Mokelumne Hill. It is owned by residents of the town, and was actively worked in 1893. C. M. Burleson & Co., of Mokelumne Hill, owners.

Quaker City Mine (Quartz).—It is 3 miles S.W. of Mokelumne Hill. See our VIIIth Report, page 144. The only work in progress was that of keeping the pumps in motion, retimbering, and maintaining accessibility. A. Knell, of Mokelumne Hill, Superintendent.

Rathgeb-Union Group of Mines (Quartz).—This property is on Calaveritas Creek, 3 miles S.E. of San Andreas. See our Xth Report, p. 63. W. Holland, of San Andreas, Superintendent.

Reed & Hillary Mine (Quartz).—See Lone Star.

Reserve Mine (Quartz).—It is on the eastern side of Carson Hill, near the summit of the mountain. See our Xth Report, p. 58. George W. Grayson, of San Francisco, owner.

Riverside Mine (Quartz).—This is 2½ miles W. of West Point, on the same vein and adjoining the Lone Star on the S. It was idle in October, 1893, but work was about to be resumed. F. J. Severns, of West Point, owner.

Safe Deposit Mine (Quartz).—See Smith's Flat and our XIth Report, p. 172. Charles Smyth, of Angels, owner.

Sheep Ranch Mine (Quartz).—This property is in the town of Sheep Ranch. Described in our VIth, VIIIth, and XIth Reports, pp. 30, 131, and 175. The shaft is somewhat deeper since then, but otherwise the conditions are unchanged. W. H. Clary, of Sheep Ranch, Superintendent.

Shenandoah Mine (Quartz).—This property is 9 miles N.E. of San Andreas, on the north side of Jesus Maria Creek, and is reached by road via El Dorado. The country rock is hydro-mica schist and quartzite, east of which is an area of amphibole rocks and diorite; these rocks strike N.W. The system of fissures constituting the Shenandoah Mine strike N. 25° E. and dip 80° E. The vein has a decided branching tendency, and is accompanied by dike rocks of fine granular texture. The

vein is usually banded where more than 6 in. in width. The central portion of the vein, which extends over two spurs of the main ridge, has, by the weight of the mountain, here bent over to the E., giving it a dip of 50° to 65° W. It may be that the torsion of the rocks has resulted in a fault, but as yet it has not been discovered. The best portion of the property lies at the north end, but it is too far distant from the mill for economical operation. A lack of pressure or insufficiency of water also puts the property at a disadvantage. The mine is in active operation. See our XIth Report, p. 176. This mine is owned by an Oakland company, with offices in the Masonic Building.

Sheridan Mine (Quartz).—This is a new "prospect," one fourth of a mile below Robinson's Ferry, on the Stanislaus River. The vein, from 2 to 10 ft. wide, may be considered as belonging to the "Mother Lode" series. It has a clean, well-defined hanging-wall, but no foot-wall, the vein striking out into the black slate in many veinlets. The quartz is splintery and stained with iron oxides and azurite. It is being developed. Thomas Richards, of Robinson's Ferry, owner.

Sloane Mine (Drift).—This claim is on the Cataract channel, 2½ miles S.E. of Vallecito. It is being worked continuously. Sloane & Sons, of Vallecito, owners.

Smith's Flat District.—In a general way all the veins of this region are quite similar, being veins and lenses of quartz in slaty, splintery, and schistose diabase, altered to chloritic and talcose schists. Reticulated systems of small quartz veins are also common. The principal mines are the Blair Consolidated, Eclipse, Gold Hill, Safe Deposit, Smyth (formerly Suffolk), Star of India, Turner, and Yellowstone. There are three parallel zones of gold-bearing rock. The Star of India is on the west, the Blair, Turner, Eclipse, and Gold Hill on the central, and the Smyth on the east zone. Still farther east are the Gold Cliff and Utica systems. See our Xth Report, p. 60.

Smyth (Suffolk) Mine (Quartz).—See Smith's Flat District and our VIIIth Report, p. 126. A cross-cut was being made in 1893. Chas. Smyth & Co., of Angels, owners.

South Carolina Mine (Quartz).—This is on the southeastern slope of Carson Hill, and is working. W. H. Worden, of Angels, owner.

Spring Gulch Mine (Placer).—This claim is on Spring Gulch, 3 miles N.W. of San Andreas, and is opened on a recent alluvial deposit, which is "piped" loose and shoveled into sluices. In active operation, and said to pay handsomely. J. S. White, of San Andreas, owner.

Star of India Mine (Quartz).—See Smith's Flat District.

Stickles Mine (Quartz).—See Utica.

Suffolk Mine (Quartz).—This property is one fourth of a mile E. of Carson Hill, on two broad zones of gold-bearing quartz and talcose and chloritic schists. The mineral zones are each about 50 ft. in width, and separated by nearly 50 ft. of diabase. With the larger masses of quartz intrusive dikes occur. Nothing has been done here except superficial work. I. Copeland, of Vallecito, owner.

Suffolk (Smyth) Mine (Quartz).—See Smith's Flat District. Chas. Smyth & Co., of Angels, owners.

Teirakoff Mine (Quartz).—See Crown Point.

Total Wreck Mine (Quartz).—See Mayflower.

Trojan and North Trojan Mines (Quartz).—These are 3 miles N.W. of West Point, on the north side of Mokelumne River, and on the "Lone Star" vein. Wilson & Co., of West Point, owners.

Tryon Mine (Quartz).—It is 3 miles S.E. of Angels, and described in our VIIIth Report, p. 129. Chas. Tryon, of Angels, owner.

Tulloch Mine (Quartz).—This is about 2½ miles S.E. of Angels, and is on the "Mother Lode" series, being a zone of quartz veins in magnesian schists. Some of the quartz is rich in gold. A new shaft was being sunk in 1893. Calcite and mariposite also frequently occur in the veins. Jas. Tulloch, of Angels, owner.

Turner Mine (Quartz).—See Smith's Flat District.

Utica-Stickles Mine (Quartz).—These properties are in the town of Angels, and have been heretofore described in our VIth, VIIIth, Xth, and XIth Reports, pp. 28, 122, 150, and 171. The general geological structure of this section is described in our Xth Report, p. 60. The mineral belt, or "Mother Lode," in this part of Calaveras County has a width of 3 miles, from the Birney Mine on the east to the Star of India Mine on the west. The shafts of the Utica and Stickles mines are now (1893) 1,000 and 1,100 ft. deep, respectively. The three shafts start on the vein at the surface, but at a depth of 500 ft. the vein takes a somewhat lesser dip, but the shafts continue at the same angle in the footwall. The stopes of this mineral zone are from 10 to more than 100 ft. wide. In these broad portions are found ribs or masses of rock containing little or no gold. The entire gold-bearing zone, as it must be called in contradistinction to a simple vein, consists of a great mass of altered diabase, which by shearing and pressure has been rendered splintery or slaty, and subsequently altered to chloritic and talcose schists, with the infiltration of much silica into the magnesian rocks, and the replacement of large masses of crushed diabase by solid massive quartz. Both the quartz lenses, bunches, and veins, and the magnesian schists, contain gold and auriferous pyrites.

Between masses of quartz are frequently seen irregular bunches, and often reticulated veins, of quartz. Perfect series of transition rocks, from normal diabase to a typical talcose schist, may be obtained in almost any portion of the mine. Power drills are used. With an Ingersoll drill a drift 8 by 8 ft. was run 196 ft. in thirty days, working three eight-hour shifts. The timber used in these mines is exclusively round and mostly large size; few sticks being under 18 in. in diameter in the main sets and many being 24 in. and 30 in. Sprags are 12 to 16 in. The cost in timbering is approximately 30 cents per ton of ore extracted. In good ground headings are made without timbering, but it is usually found safer, and a better plan, to timber as fast as excavation proceeds.

The manner of lowering timbers into this mine is interesting, but is only possible in shafts that are vertical, or nearly so, without constructing a slide or chute. The timbers, sawed to the proper length, are delivered at the collar of the shaft. A number of chains, about 8 ft. in length, provided with a dog at each end, are at hand; a workman selects a chain, drives a dog into one side somewhat above the middle of the timber, passes the chain over the end of the log and down the opposite side, where the other end is secured by driving that dog into the log. A rope 5 ft. in length, with a spike at one end, is secured to the opposite end of the log by driving the spike well in. At a convenient time the skip is hoisted above the collar of the shaft and a hook is caught

into the ring in the chain. The engineer hoists slowly until the heavy timber hangs suspended over the shaft, the rope at the bottom being used to steady it, and also to land it at any desired level. This is found to be a convenient method of handling the timbers, and does away with the necessity of block and tackle at the several stations. There is no loss of time and no interference with the use of the skips for other purposes by this method.

The absence of waste dumps at the Utica is noticeable. All waste broken in sinking the shafts and in all dead work is utilized in filling up old stopes, and as the amount obtained from these sources is insufficient, considerable waste is taken from the walls, large chambers being excavated for this sole purpose in the hard diabase. There are 350 men employed in the mine, reduction works, etc. Miners' wages are $3; shovelers and other underground laborers, $2 50. Hayward, Lane & Co., of Angels, owners.

Uptograph (*Buckminster*) *Mine* (Drift).—This claim is at Douglas Flat, 6 miles N.E. from Angels. It is on the Central Hill channel, and was formerly worked by the hydraulic method. An upper "lead" is now being drifted upon, with good results. T. Uptograph, of Murphys, owner.

Vallecito Consolidated Mines (Drift and Hydraulic).—These are located between Douglas Flat and Vallecito, and comprise a valuable tract of land. The company owning these mines contemplate the driving of a tunnel 7,000 ft. in length to drain them, the construction of a ditch and flume 26 miles in length, and the building of storage reservoirs in the mountains. I. Copeland, of Vallecito, Superintendent.

Washington Mine (Quartz).—It is 5 miles N. of Murphys, but it has not been worked for several years.

Water Lily Mine (Quartz).—See Blazing Star.

West Point District.—This is an interesting district, geologically. The mines are in a granite belt striking N. and S., and is at least 6 or 7 miles wide. Southward the granite appears to alter into dioritic and hornblendic rock; its northern limits are not known further than that the granite extends 6 or 8 miles N. from West Point. Through the granitic area numerous dikes of fine-grained, dark-green diorite are found, having an E. and W. course. Dikes of diorite of light greenish-gray color and coarse texture also occur, striking nearly N. and S. These latter appear to be the older, and often accompany important veins of the district.

A strange idea prevails in this region, viz.: that the granite is a "cap" rock, beneath which may be found serpentine and slates, and that the veins under the granite will be found larger, richer, and more permanent with increase in depth. That such was not the case was amply proven by a careful geological investigation of the region. The basis for this remarkable theory was discovered, however, in the Crown Point, Teirakoff, and Champion mines (on the "Champion dike"), the latter being formerly a large producer, but now idle.

Whittle Mine (Quartz).—It is 1 mile W. of Carson Hill. John B. Reddick, of San Andreas, owner.

Willard Mine (Quartz).—It is half a mile E. of Murphys. While in fact a quartz vein or series of veins, it was formerly worked by the hydraulic method, as are the "seam diggings" in El Dorado County. See our VIth Report (Part II), p. 35.

Yellowstone Mine (Quartz).—See Smith's Flat District and our XIth Report, p. 172. Chas. Smyth, of Angels, owner.

COLUSA COUNTY.

Although chiefly one of the richest agricultural counties, yet a portion of its revenues are derived from the mining of gold and quicksilver ores found in the rolling hills adjacent to Lake County. That this work has been intermittent lies partly in the peculiar occurrence of these ores, making their profitable exploiting a matter of close financiering and complex workings. Of late the increased facilities of transportation have encouraged the opening of good quarries and the manufacture of salt. Valuable mineral springs may also be counted among the wealth producers of this section.

Clyde Mine (Quartz).—This is situated in Sulphur Creek Mining District. Only "prospect work" was done at this mine during 1893–94. See our XIth Report, p. 183.

Keely Mine (Quartz).—This is in the Sulphur Creek District. See our XIth Report, p. 184.

Manzanita Mine (Quartz).—See Manzanita Quicksilver and Gold Mine.

DEL NORTE COUNTY.

Bald Hill Mine (Placer).—Several parties are working it in a small way. The pay gravel is over 6 ft. deep, and is said to pay well throughout.

Big Flat Mine (Hydraulic).—This claim lies on Hurdy Gurdy Creek, and contains 640 acres of gravel. The mine has yielded a large amount of gold, but is idle at present. The ditches were destroyed several years ago by excessive rains, and have never been repaired or rebuilt.

Craig's Creek.—The bars along this creek are rich throughout. Mining, however, is limited to the cradle and rocker, the creek bed only being worked. The land is patented to the lumber firms and is not obtainable by the miner at present. Bernard Purnische, of Crescent City, owner.

Miller Mine (Hydraulic).—It is on Smith River, 6 miles E. of Crescent City. A ditch and pipe-line are now under construction, and work will soon be resumed. R. W. Miller, of Crescent City, owner.

Musick Mine (Placer).—This lies below and adjoining the Miller Mine, and is worked by both sluice and rocker. The gravel, from 1 to 4 feet deep, is trammed by car to the sluice, where it is washed by water raised from the river by a current wheel. Besides gold, platinum is found in the clean-up. Ben Musick, of Crescent City, owner.

Preston Peak (Quartz).—Quite a flurry was caused some time ago by the discovery of gold quartz in this vicinity, and no doubt some good veins occur in the neighborhood, as many rich specimens were brought in, but owing to its inaccessibility, developments have been retarded.

Rice's Mine (Placer).—It lies on Mill Creek, and contains 20 acres of a bar; it is worked in a small way by sluicing. The gold, being coarse, lies exclusively on the bedrock; the gravel is practically worthless. H. Rice, of Crescent City, owner.

Yates' Beach Mine.—One mile S. of Crescent City, Mr. Yates is washing the beach sands. About 50 in. of water are brought through a flume

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12 by 12 in. to the washer. The beach at this place is littered with logs and driftwood, and the sand taken out from among them is shoveled into wheelbarrows and dumped on the washing machine, which consists of a table 3 ft. wide and 11 ft. long. From there the mixture flows onto another table 6 by 8 ft., which tends to more evenly distribute it over the whole surface. The lower end of this table consists of a screen of sheet-iron, with ¼ in. punched holes, where the gravel, driftwood, etc., are retained. The clean sand then flows over corrugated plates 6 ft. long, set at an angle of 14°, and thence onto a table covered with coarse blanket, and having a square well 4 in. deep at its upper and lower ends to catch escaping quicksilver. There are three men employed to wheel sand and one man keeps the screens clear and tends to the machine. It is said that about $5 is taken out to the man employed. A. L. Yates, of Crescent City, owner.

EL DORADO COUNTY.

This county is as well supplied with gold-bearing veins as any part of the mineral belt, and is equally well furnished with facilities for water power, and better than some as regards timber. The formations do not show the same regularity which is found along the "Mother Lode" in the counties south; the slates have in part been greatly crushed and altered, and the granitic rocks come lower down the ridges. It is in this county that the so-called *seam diggings* have found their greatest development, furnishing a large proportion of the gold output of the county with comparatively small outlay for permanent plants, making it possible for men of small means to engage profitably in the mining business. There is considerable of this kind of ground still awaiting the miner's advent. Unfortunately, agricultural patents covering these, in a measure put a barrier in the way of the prospector, and lose to the community the possibility of an increased output of gold from this direction.

During the writer's stay in Georgetown, parties plowing a field below town turned up quartz from a seam that yielded $400 in gold, showing that in many parts the wealth below is more valuable than the product of the surface.

For years the county has not received the attention that its mineral wealth merits, but the success attending the deeper explorations in the Taylor, Springfield, Church, Big Cañon, Gentle Annie, and other mines should be an encouragement to other operators to delve deeper in their now idle mines.

Adam's Gulch Mine (Quartz).—It is 2 miles N. of Nashville, and is 1,500 by 600 ft. It shows a 2 ft. vein of quartz with a N. and S. course, on which two shafts have been sunk about 100 ft. deep. J. C. Heald, of Nashville, owner.

Alpine Mine (Quartz).—See our VIIIth Report, p. 167.

Argonaut Mine (Quartz).—See our Xth Report, p. 176.

Armstrong & Roberts Mine (Drift).—It is 3½ miles S. of Grizzly Flat, and contains 30 acres of ground. A channel 60 ft. wide runs through the ground in a N.E. and S.W. course, and is tapped by a tunnel 600 ft. in length. The channel is lava-capped. Pay gravel 5 ft. thick. The bedrock and most of the bowlders are granitic. One man works the

claim, washing the extracted gravel two or three times a year. W. T. Armstrong and — Roberts, of Grizzly Flat, owners.

Aultman Mine (Quartz).—It is situated 2 miles E. of Greenwood, and is supposed to be on the same vein as the Idlewild Mine. It is 1,500 by 600 ft. of patented ground. The vein courses nearly N. and S., with slate and diabase walls, pitching slightly to the E. The walls contain considerable lime; small stalactites having formed in the drifts. The croppings have been exploited by an open cut over 30 ft. deep; a cross-cut tunnel driven at an expense of $35 per foot has penetrated 500 ft., cutting the ledge 250 ft. below the croppings; at this point a shaft was sunk 35 ft. deep and drifts turned both N. and S. about 25 ft. The vein is 103 ft. wide between walls. The quartz is milk white and carries some iron sulphurets. The 2-stamp mill and office buildings have been destroyed by fire. Water power is available. Timber is plentiful. John Smith, of Greenwood, owner.

Bald Eagle Mine (Quartz).—See Crown Point Mine.

Baldwin Mine (Quartz).—It is 2 miles E. of Nashville, in T. 8 N., R. 10 E., and is 3,000 by 300 ft. The vein, 7 ft. wide, runs a little W. of N., and lies E. of the main "Mother Lode"; it dips toward the E. at an angle of about 60°; the walls are slate and porphyry. The vein carries 0.5 per cent sulphurets. Two shafts, supplied with steam hoisting works, have been sunk 175 ft. and 60 ft. deep, respectively, and drifts turned from the former. One foot of gouge accompanies the vein. They usually employ 7 men. E. J. Baldwin, of San Francisco, owner.

Barnes Mine (Quartz).—It is 2½ miles N.E. of Shingle Springs. The vein lies on the contact of serpentine and hornblende porphyry. Considerable work has been done on the surface along this contact, as shown by the numerous shallow openings, although but little quartz appears. The main workings consist of several shafts. This and other mines on this belt produce much telluride of gold. H. L. Robinson, of Placerville, owner.

Base Bonanza Mine (Quartz).—Located in Sec. 32, T. 12 N., R. 10 E. Well defined ledge; east wall diorite and west wall serpentine.

Beattie & Parsons Consolidated Mine (Seam Digging).—See our XIth Report, p. 203. It is situated at Georgia Slide, 1½ miles N. of Georgetown, in Secs. 3 and 34, Tps. 12 and 13 N., R. 10 E., and contains 60 acres on the south bank of Cañon Creek, on the porphyry seam belt. It is worked as a placer, the pit being about 150 ft. deep. The formation is traversed by slates and schists, and intercepted by numerous gold-bearing quartz seams, varying in width from almost nothing to several inches. The mass containing these seams is loosened by blasting and washed through 1,500 ft. of sluices, set on a grade of from 14 to 18 in. per box of 16 ft.; these being lined with 8 in. wooden blocks. If any gold is seen in the quartz, it is laid to one side and crushed in the hand mortar, but necessarily many such pieces escape and are washed into Cañon Creek. The upper boxes are cleaned up once or twice a week, and the remainder three or four times a season. Many of the slates in this belt carry from $2 to $3 per ton, mostly in coarse gold, which sells for $18 50 per ounce. Beattie & Parsons Consolidated Placer Mining Company, owners; C. Beattie, Superintendent.

Benfeldt Mine (Drift).—See our VIIIth and Xth Reports, pp. 187 and 197.

Berry Mine (Quartz).—See True Consolidated.

Bidstrup Mine (Quartz).—It is in Logtown, and is a small claim, 800 by 400 ft. F. T. Bidstrup, of Mud Springs, owner.

Big Cañon (Oro Fino) Mine (Quartz).—See our VIIIth Report, p. 174. It is situated 5 miles S. of Shingle Springs, and has been newly equipped with steam and water hoisting works, air compressor, 20-stamp mill, and chlorination plant. The ore body is quite peculiar, and while it has its counterparts in several smaller ones in the vicinity, yet it is very different from the ordinary type of gold-bearing quartz veins. As shown in an open cut made on the croppings, the ore body occurs in the form of an immense lens, having an extreme width on the surface of more than 100 ft. and tapering toward both ends. The ends are not reached in the cut, which is 400 to 500 ft. long. This opening is 20 ft. deep in places, extending down to the undecomposed ore. The upper part of the material taken out was sluiced. At the time of examination, in October, 1893, the three-compartment shaft had reached a depth of 215 ft., costing over $40 per foot, and cutting through the ore body 70 ft. The dip is a little less than 40° to the E.; the strike about N. and S. As far as the developments have gone, the hanging-wall has been found to be a serpentine schist, quite loose and difficult to hold up, while the foot-wall is a greenstone schist, judged to have resulted from the decay of a diorite or diabase dike. On the 100 ft. level a great chamber fully 100 ft. across has been excavated out of the massive ore body. No timber is used, the roof being held up by pillars of ore. On the hanging-wall several feet of ore is left to hold back the soft serpentine. An examination of this ore body shows it to be a very hard, compact, and fine-grained mass of gray quartz, which is thickly sprinkled with small but regular crystals of iron pyrites. Gold occurs both in the free state and in combination with sulphurets. The ore carries from 8 to 10 per cent of sulphurets. The ore body is sharply defined from the hanging-wall, but in places blends into the foot-wall in such a manner as to show conclusively that it is not a fissure vein in the usual sense, but occurs as a replacement of the green schist. Not only were excellent samples found of the gradual transition to this green schist by a decrease of the quartz and sulphurets, and an increase of the green chloritic matter, but several irregular bodies of ore were observed to lie wholly separated from the main one and to present every appearance of being replacements. More generally the contact between the ore and the foot-wall is rather sharp. The serpentine on the hanging-wall has a very limited extent, seeming to swing away from the ledge at both ends; on the S. being replaced by black slate, and on the N. by a decomposed rock, perhaps originally a diabase. Immediately E. of the serpentine is an irregular body of fresh diabase, precisely similar to that so characteristic of the "Mother Lode." The number and variety of the dikes in almost immediate contact with this ore body is quite remarkable.

A compressor, with capacity for eight drills, runs two in the shaft and one in the drift. Twelve men are engaged in sinking, and seven break ore for the mill. A tramway and elevator convey the ore into the mill, which is supplied with a rockbreaker and self-feeders. The mill is unique, the stamps being of the unusual weight of 1,400 lbs., this increase being obtained by a boss of 220 lbs. being attached to the upper end of the stem; the tappet increased to 345 lbs. with three keys; and the stems lengthened by 2 ft. The shoes are chrome steel and weigh between 120 and 130 lbs.; the dies are iron; the speed is 100 drops per minute, 7 in. high. The duty of these stamps is 2 tons each in twenty-four hours.

An 8 in. silvered plate is used on the front, inside the battery, and 3 miner's inches of water is required.

The apron plates are 14 in. by 4 ft., and each battery is supplied with a double set of sluice plates, enabling the cleaning of the same to proceed without hanging up the battery; these sluice plates are 18 in. wide by 27 ft. long, and are set on a grade of 3 in. to the foot. The batteries, which are cleaned up once a month, produce 30 per cent of the amalgam.

The sulphurets are hauled by wagon to the chlorination works about 100 yards distant. This plant is built for working 5 tons wet per twenty-four hours, using a reverberatory furnace, with single hearth 75 ft. long and working doors on both sides. Three gas generators and four chlorination vats comprise the plant, no silver being saved. The concentrates are worked upward of 90 per cent, the gold being .980 fine. The tailings are said to assay from $1 to $1 50 per ton.

The mill and concentrators take power from a 6 ft. Pelton wheel, working under 395 ft. pressure. The compressor and hoist are run by steam or water, the latter acting on a 6 ft. Dodd's wheel under 300 ft. pressure, delivered from the Crawford ditch through an 18 in. pipe. Forty men are employed. Big Cañon Gold Mining Company, owners; G. B. Pierce, Superintendent.

Big Sandy Mine (Quartz).—See our Xth Report, p. 173. It is situated in T. 10 N., R. 11 E., near Kelsey, on the porphyry belt. Big Sandy Mining Company, of Kelsey, owners; J. Kelly, Superintendent.

Bitters Claim (Placer).—This property is situated on Missouri Cañon, near Volcanoville, and comprises 80 acres of ground. W. Kinny and — Morgan, of Georgetown, owners.

Black Lead Mine (Quartz).—This mine lies 6 miles S. of Shingle Springs. It is so termed from the appearance of the quartz, which is quite black. As exposed in the old shaft, the vein appears to be inclosed in slate. The hoisting works and other buildings have all been burned.

Blair Mine (Drift).—See our Xth Report, p. 179.

Blue Rock Mine (Seam).—It is situated at Georgia Slide, adjoining the Beattie & Parsons seam mines on the N.E., and working the same seam belt. See our XIth Report, p. 203. Beattie Bros., of Georgetown, owners.

Board Mine (Quartz).—It is half a mile E. of Greenwood, and comprises two claims of 600 by 600 ft., side by side. The vein courses E. and W. and dips to the N., showing a 4 ft. vein. A tunnel has been run 60 ft., cross-cutting the slate; a second tunnel has been started to the north. W. Board, of Greenwood, owner.

Bona Forsa Mine (Quartz).—See our Xth Report, p. 177.

Boneset Mine (Quartz).—It is in T. 10 N., R. 9 E., 6 miles N. of Shingle Springs, near Weber Creek. The property extends three quarters of a mile N.E. and S.W. along the vein, which dips N. about 70°. The country rock is granite. The vein on the croppings shows a width of 30 ft. The quartz carries a fair percentage of iron and copper sulphurets, and has a lively character. A tunnel 130 ft. in length cross-cuts the vein 40 ft. below the croppings. From the Weber Creek side a good opportunity is afforded for a deeper tunnel, which would give 350 ft. backs. Water power can be brought on the claim. M. E. Gates, of Sacramento, owner.

Bower Mine (Seam).—See our XIth Report, p. 204.

Brass's Claim (Drift).—See Murzo Mine.

Bright Hope Mine (Quartz).—It is in Sec. 2, T. 12 N., R. 10 E., in the immediate neighborhood of Georgetown, and is a promising "prospect." See our Xth Report, p. 177. H. W. Hurlbert, of Georgetown, owner.

Brown Bear Mine (Quartz).—See our VIIIth Report, p. 182.

Buckeye Hill Gold Mine (Drift).—It is on Buckeye Hill, 9 miles N.E. from Georgetown and 2 miles W. of Volcanoville. It is an old river channel with a N.E. and S.W. course, 2,730 ft. above sea-level, and 1,000 ft. wide between rim rocks, carrying blue gravel with a red cement capping. Facing the American River, the west side of the claim was hydraulicked and shows a bank 127 ft. high, with alternating strata of gravel and cement; the facilities for impounding are quite favorable and the mine could be worked to greater advantage by this method.

From the east side of the claim a tunnel has been run into the channel 200 ft. through the slate rim rock; 150 ft. from the mouth an upraise of 35 ft. breaks into the gravel. The channel is quite steep, with a very uneven floor. The gravel breasts are 100 ft. wide and 5 ft. high on an average, although in places the gravel has been taken out 30 ft. high. As timber is scarce, after extracting the bottom gravel, which carries coarse gold, the timbers are recovered and the ground allowed to settle, losing the top gravel, which carries scaly gold. A bench of the main channel supplies the present output of gravel, which amounts to three carloads, of 1,500 lbs. each, to the breaster per day. The dump holds several hundred carloads. The dirt is washed with water from neighboring springs through 10 boxes, set on a 13 in. grade to the box, paved with slat riffles. The washing occurs once every two or three weeks. The gold sells for $17 50 per ounce. J. J. Flora, of Georgetown, owner.

Burt Alley Claim (Placer).—It is 2 miles below the crossing on Otter Creek, of the Georgetown and Volcanoville trail, in T. 13 N., R. 11 E. It is 1,320 ft. along the course of the creek by 700 ft. wide. A bedrock cut is being blasted up the creek, to work some valuable virgin gravel, left from early days. A large amount of big bowlders have to be removed. Forni & Smeder, of Georgetown, owners.

Cañon Creek Fluming Company's Mine (Placer).—It is in Secs. 32, 33, 34, T. 13 N., R. 10 E., 1½ miles N. of Georgetown and immediately below Georgia Slide. It embraces 1¼ miles, or 150 acres, of patented ground in the bed of Cañon Creek. The ground is a tailings deposit, having been the dump from all the Georgia Slide and Oregon Gulch mines, which have been working off and on for the last forty years, but it also contains 10 to 15 acres of valuable virgin gravel. On account of a rocky reef across the creek at the lower end of the claim, all the quartz from the Georgia Slide mines has been retained on this ground. The company own an excellent water power. G. W. Simpers et al., of Greenwood, owners.

Carrie Hale Mine (Drift).—It is situated at Henry's Diggings, 3½ miles S. from Grizzly Flat, and contains 260 acres of patented land. The channel, which is capped by lava 100 ft. deep, runs N.E. and is 60 ft. wide, with from 5 in. to 5 ft. of gravel. The bedrock tunnel is 400 ft. long. The gravel is now being blocked out in 12 ft. breasts, carried 5½ ft. high, and timbered with single posts and caps. The gravel is blue, carrying granite bowlders and resting on a granite bedrock, next to which the best pay is found, though some gold is found scattered throughout. The gold is worth $17 per ounce. The gravel is washed twice

a year, through 12 boxes, slat riffles; the water, which is taken from the Cole ditch, costs from $1 50 to $2 per twelve hours. The tailings are dumped into the Middle Fork of the Cosumnes River. J. H. Bradley, of Placerville, owner; H. C. Roberts, of Grizzly Flat, lessee.

Cedarberg Mine (Quartz).—This property is situated 2½ miles N. of Greenwood, and is 1,500 by 600 ft., through which runs a 2 ft. vein between slate walls having a N. and S. course, and an easterly dip at an angle of 45°. A shaft has been sunk 300 ft. deep on the vein. E. W. Hulford, of Oakland, owner.

Cement Hill Mine (Drift).—It is 4 miles from Georgetown. A prospect bedrock tunnel is being run to strike a gravel channel supposed to run E. and W. The tunnel, which is in slate, has reached a length of 550 ft.; at 150 ft. connection was made with the surface, 60 ft. above, through an air shaft. The ridge is lava capped.

Central Mine (Quartz).—See Inez Mine.

Chester Mine (Quartz).—Southerly extension of the Rose. See our VIIIth Report, p. 182.

Chili Ravine Mine (Drift).—Idle. See our VIIIth and Xth Reports, pp. 194, 179.

China Hill Mines (Quartz).—They are a mile N.E. of the Big Cañon Mine. A vast amount of work has been done here, chiefly in the form of surface cuts, though there are several tunnels and shafts. The gold is found in "pockets" in a N. and S. vein inclosed in hornblende porphyry.

Church (El Dorado) Mine (Quartz).—This property was described in our VIIIth and Xth Reports, pp. 191 and 171, and is situated in T. 10 N., R. 11 E., 3 miles S. of El Dorado; it is 1,500 by 600 ft., and is one of the deepest mines in the county. The present working shaft is a three-compartment, using skips; the workings extend from the 400 to the 1,000 ft. level. The plant contains a compressor for four Ingersoll drills, with an 8 in. Cornish pump, with two jackheads and two plungers. The ore from the present workings carries 2½ per cent of sulphurets, assaying $140 per ton.

A new 10-stamp mill has been built; stamps 900 lbs. in weight, 3½ in. stems, 14 ft. long, giving 102 drops, of 5 in., per minute; discharge 7½ in. through a No. 40 mesh sheet-tin screen, with a duty of 2 tons per stamp in twenty-four hours. The plates consist of an 8 in. piece inside the battery; an apron 5 ft. by 5 ft., and 16 ft. of sluice plates 16 in. wide. The plates are scraped every day, and the battery cleaned up once a month; 75 per cent of the amalgam is taken from the latter. The gold is worth $17 per ounce. The mill is provided with three Frue and one Johnson concentrator and a Dodge rockbreaker and Challenge self-feeders. The entire plant is operated by water power under a 400 ft. pressure, furnished from the Crawford ditch. Church Gold Mining Company, owners; J. Richards, of El Dorado, Superintendent.

Church Union (Springfield) Mine (Quartz).—See our VIth Report (Part II), p. 43. Idle.

Cincinnati Mine (Quartz).—It is 2½ miles S. of Placerville, in T. 10 N., R. 11 E. The claim is 1,300 by 600 ft. and the vein is supposed to be the same as the Epley, on the opposite side of Weber Creek. M. Miller and D. J. Knighton, of Diamond Springs, owners.

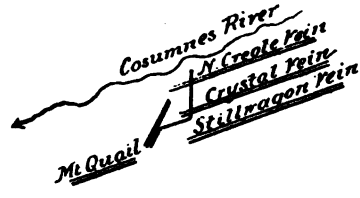
Cinnamon Bear Mine (Quartz).—Two miles N. of Placerville. Idle.

Collins & Patterson Claim (Placer).—This prospect is situated on the porphyry seam belt 2 miles N.E. of Georgetown, on Cañon Creek. Two men are sinking a shaft. Collins & Patterson, of Georgetown, owners.

Cousin Jack Mine (Quartz).—It is situated 5 miles S.W. of Grizzly Flat. It comprises 1,500 by 600 ft., with a N. and S. vein, dipping W. about 60°, and varying in width from 1 to 4 ft. The walls are slate. About 400 ft. to the E. is the contact with granite. Three tunnels have run on the vein; the deepest, 400 ft. long, gives 300 ft. backs; No. 2, 250 ft. above, is 300 ft. long; from this a winze 70 feet deep has been sunk on good-paying ore. The pay shoot pitches N., and is richest where the vein is narrow. Cole's ditch runs 300 ft. above the mine. About an inch of water runs from the tunnel. Timber is abundant. Mrs. M. Jeffrey, of Grizzly Flat, owner.

Crown Point (Bald Eagle) Mining Claim (Quartz).—It is 1½ miles S.E. of Diamond Springs, in Sly Ravine, 800 ft. E. of the Church Mine, and is 1,500 by 600 ft. The vein has a course N. 20° W., dip nearly vertical, within black slate walls. On the surface a number of small quartz stringers crop out. A two-compartment vertical shaft has been sunk. The present owners do only assessment work. The quartz carries some good looking sulphurets. J. Richards, A. Koch, and J. W. Estes, of Diamond Springs, owners.

Crystal Mine (Quartz).—It is in T. 9 N., R. 13 E., on the Middle Fork of the Cosumnes River, 5 miles S. from Grizzly Flat. There are four claims in the property. The Mountain Quail vein is in line with the Stillwagon vein, running E. and W., as do the Crystal and North Creole veins. The Creole vein is more N. and S., with a nearly vertical dip, whereas the others dip to the S.: the Crystal about 70°, and the Mountain Quail nearly vertical. There are 1,200 ft. on the Mountain Quail, 3,000 ft. on the Creole, and 3,200 ft. on the Crystal. Width of Creole, 4 ft.; Crystal, 4 to 6 ft., and Mountain Quail, from 3 to 10 ft. All these veins are in hard granite. In the Crystal the vein matter is not all quartz; along the foot-wall is the principal ore body. The Crystal has a shaft 250 ft. deep, and two drifts (65 ft. apart) 500 and 900 ft. long, and four ore shoots pitching W. The Mountain Quail has two ore shoots, varying in length from 50 to 150 ft. The North Creole has two ore shoots; the pay streak being 2 ft. thick; the shaft is 70 ft. deep. A main working tunnel (said to have cost $80,000) has been driven by hand 1,208 ft. through solid granite to the Crystal vein, and is to be continued along that vein until it reaches the Mountain Quail. At present the mouth of the tunnel is caved and the tunnel filled with water. In the main tunnel an air shaft connects with the surface 200 ft. from the mouth, and where the tunnel intersects the North Creole a winze is sunk 65 ft. deep.



PLAN OF CRYSTAL MINE, EL DORADO CO.

An 8-stamp mill, with 650 lb. stamps, belongs to the property and is driven by water power acting under 200 ft. pressure on an 8 ft. Hurdy wheel. The company owns the water power. Its ditch is 1½ miles long. The mill is supplied with 16 ft. of apron and sluice plates, set on a grade of 2 in. to the foot, followed by 36 ft. of blanket sluices. L. L. Alexander, of Ohio Ranch, owner.

Crystal Mine (Quartz).—It is 3½ miles S. of Shingle Springs, in Sec. 28, T. 9 N., R. 10 E. The claim is 1,220 by 600 ft., and has a N. and S.

vein 3 ft. wide, dipping E. 50° between slate walls. An incline shaft 250 ft. deep, with steam hoist, connects with a tunnel below. A cross-cut tunnel, 70 ft. below the collar of the shaft, 350 ft. long, conveys the ore to the level of the hill. The latter has 10 stamps of 650 lbs. weight, and is worked by water power from the Crawford ditch under 112 ft. head, applied to two Pelton wheels of 4 ft. and 8 in. in diameter; the latter for the concentrators. The percentage of sulphurets in the ore is large. Idle. G. Phelps et al., of Mud Springs, owners.

Dailey Mine (Quartz).—It is on Clear Creek, 3 miles S. of Grizzly Flat. The claim is 3,000 by 600 ft., and shows a vein from 18 in. to 3 ft. wide, carrying a fair percentage of iron sulphurets, and striking N. and S. A tunnel started on the banks of Clear Creek has been driven on the vein 600 ft. At the mouth of the tunnel is a small rotary stamp used for prospecting purposes. Dailey et al., of Grizzly Flat, owners.

Dalmatia Mine (Quartz).—This property has been fully described in our VIIIth, Xth, and XIth Reports, pp. 177, 174, and 201. It is 8 miles N.W. of Placerville. Now idle, but to be reopened shortly. American River Syndicate (Limited), owners; C. G. Pearson, of Kelsey, Superintendent.

Darling Mine (Quartz).—See our XIth Report, p. 202. Idle.

Davidson Mine (Quartz).—This old mine lies 3 miles N.W. of El Dorado, on the eastern edge of the slate belt which runs north from Big Cañon. A 20-stamp mill was put up on this property many years ago for working a vein situated 100 ft. W. of the contact in the slate. On the contact is a large vein which has been worked but little, while but a few feet away in the slate is another closely resembling the Big Cañon ore body. The mine has been bonded, and it is expected that it will be opened up again.

Defiance Mine (Quartz).—This old mine is located 5 miles N.E. of Shingle Springs. Here is said to occur a large body of low-grade ore inclosed in green chloritic schists.

Dividend Mine (Placer).—It is 2½ miles W. from Shingle Springs, in T. 10 N., R. 9 E. The company own 3,136 acres of ground on Kelly Creek. The gravel deposit is quite extensive and worked through ground sluices. It has a soil capping of about 10 ft., making the stripping expensive; the gravel is from 1 to 3 ft. thick, lying on a soft granite bedrock, and contains a little quartz. Ground-sluicing is carried on during winter and spring; the season averages six months. The claim, though operated for a number of years, has plenty of good ground in reserve. About 2,000 ft. in length have been worked. Seven men are employed. The gold is .888 fine. The ground is poorly situated for dumping. The gold is apparently derived from numerous small seams throughout the bedrock in this vicinity. Ayl. Pelton et al., of Shingle Springs, owners.

Donozo Gold Mine (Quartz).—It is half a mile E. of Greenwood, and is 1,500 by 600 ft. It is on the same mineral belt as the Taylor Mine, showing in the 60 ft. of tunnel run on the vein a width of 20 ft., with a course N. 40° W. and dipping E. about 55°. J. Donozo, of Greenwood, owner.

Eagle King Mine (Quartz).—It is 2½ miles N. of Grizzly Flat, in close proximity to the Melton Mine, and is 1,500 by 600 ft. It has a N. and S. vein, dipping slightly to the W., with a width of from 2 to 4 ft.; the walls are a decomposed granite. The vein is worked through a tunnel driven 800 ft. on the ledge. A winze, 200 ft. from the mouth of the

tunnel, is 30 ft. deep, and shows 28 in. of a vein in the bottom, carrying iron, lead, and zinc sulphurets. A little stoping has been done at this point above the tunnel level. The entire length of the vein in the tunnel shows good milling ore. There are 300 ft. of backs, from breast of tunnel. No mill is on the property, but water power can be obtained through the Eagle ditch, with 200 ft. pressure. This section of country is very well timbered. The owner works alone. See our VIIIth Report, p. 178. J. Melton, of Grizzly Flat, owner.

Edner, Charles, Claim (Quartz).—It is 4 miles E. of Fairplay, and is 1,500 by 600 ft.; the course of the vein is N. and S.; the dip is to the E., between granite walls. A tunnel is run on the vein 150 ft., and in the gulch below a 20 ft. shaft has been sunk. The quartz carries considerable iron and lead sulphides. One and a half miner's inches of water issues from the tunnel. Water power can be obtained from the Michigan Bar ditch. C. Edner, of Omo Ranch, owner.

El Dorado Mine (Quartz).—See Church Mine.

El Dorado Big Tunnel Mining Company's Mine (Quartz).—Its property is situated 2 miles N. of Placerville, in Big Cañon, and comprises 120 acres. The tunnel was started on a N.E. course to cross-cut the mineral belt, from the east side of the cañon, and has penetrated to date 662 ft., cutting in that distance several quartz veins ranging from 3 to 6 ft. in width. At the end of the tunnel 97 ft. of the very finest quality of roofing slate has been penetrated. At the mouth of the tunnel is a 5-stamp mill, run by water power. El Dorado Big Tunnel Mining Company, owners; G. W. Campbell, of Placerville, Secretary.

Elliot Mine (Quartz).—It is 2½ miles S. of Placerville, in T. 10 N., R. 11 E. The claim, which is only 800 by 300 ft., is immediately opposite the Epley Mine, on the banks of Weber Creek, and the vein has the same N.W. course, and dips 80° E. The vein along both slate walls through the entire length of the claim is uncovered, showing 4 ft. of milky quartz with few sulphurets. A shaft sunk 50 ft. on the vein connects with a cross-cut tunnel from the creek. J. J. Elliot, of Placerville, owner.

Emma Mine (Quartz).—See our Xth Report, p. 176.

Epley Mine (Quartz).—See our VIIIth and Xth Reports, pp. 186 and 173.

Equator Mine (Quartz).—See our VIIIth and Xth Reports, pp. 190 and 172. It is situated 3 miles S. of Diamond Springs, on Mathenas Creek, in T. 10 N., R. 11 E. Idle. Capt. T. Buckley, owner.

Esperanza Mine (Quartz).—See our Xth Report, p. 175. It lies in Sec. 28, T. 12 N., R. 10 E. Vertical double-compartment shaft, 10 by 4½ ft., inside of timbers, and 200 ft. deep. Steam hoist. About 300 ft. of levels have been run. The cross-cut at the "200" shows 64 ft. of low-grade ore between the walls.

Esperanza South Extension (Quartz).—Only assessment work and surface prospecting have been done.

Eureka Mine (Quartz).—It is in Georgetown, in T. 12 N., R. 10 E., and is 1,200 by 300 ft. Three parallel ore bodies having an N.E. and S.W. course are known. An incline shaft, 180 ft. deep on the main or center vein, showed 12 ft. of quartz. At 50 ft. depth a drift was run from the shaft and cut the E. vein. A small tunnel run on the W. vein exposed quartz 9 ft. wide. See our XIth Report, p. 203. Idle. E. B. Lee, of New York, owner.

Faraday Mine (Quartz).—See our VIIIth Report, p. 186. Idle.

Flagstaff Mine (Quartz).—See our VIIIth Report, p. 178. Idle.

Fort Yuma Mine (Quartz).—This mine is located on Dry Creek, 1 mile S.E. of the Big Cañon Mine. The vein is inclosed in black slate, which strikes N. and S., with a nearly vertical dip. Two claims have been located on the ledge, which is traceable for several thousand feet. The quartz has a ribbon character and varies from 2 to 3 ft. wide. A 10-stamp mill is located on the property. — Hale, of Omo Ranch, owner.

French Claim (Placer).—This property is situated on the seam belt, one quarter of a mile W. of Greenwood. The claim is 1,400 by 600 ft., and originally belonged to the California Water Company as a hydraulic. The crevices in the large pit of the former hydraulic are being worked; this pit is about 600 ft. long, 200 ft. wide, and about 80 ft. deep. The belt runs N. and S. and the quartz seams diverge in all directions, and carry the gold. The pit is estimated to have yielded $500,000. A shaft sunk 45 ft. in the bottom of the pit proves the continuity of the vein downwards. The belt has been traced across from the North Fork to the South Fork of the American River. The gold is high grade, being worth $20 26 per ounce. See our XIth Report, p. 204. L. Lechance, of Greenwood, owner.

French Hill Mining Company's Mine (Quartz).—Is 6 miles from Greenwood, in T. 13 N., R. 9 E., near Spanish Dry Diggings, and contains 160 acres in the porphyry seam belt, which here has a N.W. and S.E. course. The main quartz seam dips about 45° E., with an average width of 1½ ft., though attaining greater proportions in swells. The belt is excavated from 10 to 40 ft. in width. The workings are through a tunnel and an open cut; deep holes sunk by churn drills and exploded, throw large masses of rock into the cut, which are sluiced down to the mill 250 ft. below through 800 ft. of boxes 18 in. wide, paved with wooden blocks and set on grades varying from 8 in. to 2 ft. per box. The larger pieces of waste slate are gotten rid of by passing over a grizzly dumping into a neighboring ravine. By this method large amounts of ore are swiftly and cheaply delivered to the mill, which has 10 stamps of 750 lbs. weight, dropping 100 times per minute with a 5 in. drop and 8 in. discharge. The drop is arranged 1, 5, 2, 4, 3, feeding from No. 2. The battery is provided with an 8 in. plate on the inside and with No. 6 perforated sheet-tin screens. The aprons have an area of 52 in. by 12 ft., set on a grade of 1½ in. to the foot; below are quicksilver traps, blankets, and sluices with riffles. The plates are dressed every day, but only scraped once a week. The line of sluices to the mill and to the battery are cleaned up once a month. Power is derived from the Georgetown ditch, the water being used on a 6 ft. Pelton wheel, under 250 ft. of pressure. A. J. Johnston et al., of Sacramento, owners.

Garden Valley Mine (Quartz).—It is in the diorite, W. of Esperanza.

Garfield Mining Company's Mine (Quartz).—It is in T. 18 N., R. 11 E., about one fourth of a mile from Volcanoville, and contains 1,500 by 600 ft. The vein, in black slate, courses N. and S. and dips 55° W. near the surface, straightening up to 70° with depth. An incline shaft on the vein, 120 ft. deep, with a short drift near the bottom, exposes some pay ore. A tunnel, started at a point deeper than the bottom of the shaft, in running 700 ft. has cut several quartz stringers, but none of value. E. W. Chapman, of Greenwood, owner.

Garfield and Excelsior Consolidated Gold Mine (Quartz).—It is 1 mile N.E. of Greenwood and contains 3,000 by 600 ft., on the same course as the Idlewild Mine. A serpentine dike runs a short distance back of and parallel with the vein, which is in slate; the foot-wall is highly mineralized, the sulphurets carrying gold; the vein is 20 ft. wide. Of the four tunnels the uppermost, No. 1, is 275 ft.; No. 2, 325 ft.; No. 3, over 400 ft., and No. 4, 200 ft. in length; none of them have reached the ledge to date. The surface along the outcrop is gold-bearing, as are all the ravines heading toward it. Some ground-sluicing is being done. Free water under 200 ft. pressure for six months in the year can be obtained. F. G. Bilty et al., of Greenwood, owners.

Garibaldi Consolidated Gold Mine (Quartz).—It is three fourths of a mile from Greenwood, and embraces 3,000 by 600 ft. The vein courses N. 30° W., dips 55° N.E., in slate, with a width of 6 ft. No developments sufficient to establish the value of the property have been made. Mrs. Lee and J. Wolf, of Greenwood, owners.

Gentle Annie Mine (Quartz).—It is 1½ miles N. of Placerville, in Sec. 6, T. 10 N., R. 11 E., and comprises an area 1,000 ft. long by 1,500 ft. wide, and employs 18 men. The two parallel veins, from 50 to 80 ft. apart, course N. 30° W., with a dip of 70° to the E. They are from 10 to 40 ft. wide, between porphyry hanging- and slate foot-wall. The quartz is of ribbon structure, interstratified with black slate, carrying from 2 to 2½ per cent of sulphurets, mostly iron and galena.

The developments consist of two tunnels, one on mill level, 70 ft., and the other at the N. end of the claim, 400 ft. in length; both on the ore body. Below the mill-level tunnel are three winzes, from 10 to 40 ft. deep, all in ore. The working shaft intersects the tunnel about 500 ft. from the mouth, at 100 ft. depth, and continues 130 ft. below the same; it is partly incline, partly vertical. Eighty feet below the tunnel level a drift has been run N. from the shaft 130 ft., and about 200 ft. of ground has been stoped. A jackhead pump handles the water (about 2 miner's inches); the mine is run by a Green wheel operated with water from the El Dorado ditch, while a 12 horse-power steam hoist, situated at the intersection of tunnel and shaft, raises the ore to mill level. A "National" compressor, with Rand, Little Giant, and Slugger drills, is used. The mine is timbered throughout, using pine and spruce at a cost of 2 cents per running foot.

The reduction works consist of a 10-stamp mill, Challenge feeders, and 2 improved Frue vanners with 6 ft. belts, handling 1¾ tons per stamp per day, all run by a 4½ ft. Knight wheel under 160 ft. pressure, using 50 in. of water. The stamps weigh 750 lbs.; the speed is 100 drops per minute; the drop is 5 to 6 in.; the discharge 6 to 8 in., using a No. 40 punched sheet-tin screen. The mortars are wide and deep, and furnished with plates inside. The aprons are 52 in. wide by 3 ft. long, and set on a grade of 2 in. to the foot. The sluice plates are double, 12 ft. long, and are followed by four blanket sluices 6 ft. long and 14 in. wide, which are washed twice during a shift. The apron plates are only scraped once a month, though dressed twice a day; 40 per cent of the amalgam comes from these plates. See our Xth Report, p. 177. John Melton and G. B. Parlow, of Placerville, owners.

Gold Note Mine (Quartz).—See Philadelphia Mine.

Golden State Mine (Quartz).—This is 4 miles N.E. of Georgetown, and embraces 1,500 by 600 ft. of patented land. It is a belt containing

a network of quartz seams, worked from 200 to 300 ft. wide, with an N. and S. course. Aside from cuts, tunnels, and shafts made for prospecting purposes, the mine is worked through an open cut, the material being blasted down and washed through sluices. See our XIth Report, p. 204. W. Barklage et al., of Georgetown, owners.

Gopher and Boulder Mine (Quartz).—See our VIIIth Report, p. 175.

Grand Victory Mine (Quartz).—It is in Sec. 34, T. 10 N., R. 11 E., 7 miles S.E. from Placerville, on Squaw Creek, and comprises 160 acres. See our VIIIth and Xth Reports, pp. 194 and 178. The ore body is incased in slate, with an N.W. trend and nearly vertical dip, with a width of over 100 feet; the quartz seams are interstratified with the slate and with a black silicious rock, the whole carrying a large percentage of sulphurets, and also, it is supposed, selenium; the less decomposed and harder strata appear to carry the most free gold. Under the lately introduced cyanide process, working the decomposed portions of the ore, the yield has been largely increased, so it is reported. The developments in the mine consist of large pits sunk on the ore body, some of which are 60 feet deep and wide and several hundred feet long, connected near the bottom with the mill level through short tunnels. Grand Victory Mining Company, of Placerville, owners; M. B. Silver, Superintendent.

Gray Mine (Quartz).—See Old Gray Mine.

Gray Eagle Cliff Mine (Drift).—It is in Volcanoville, and contains 100 acres. The ancient channel has an E. and W. course, 300 ft. width, between slate rim rocks. The cemented pay gravel is from 2 to 4 ft. deep, with a capping of alternating strata of cement and gravel. It is worked through a tunnel starting at an outbreak of the gravel and run partly in bedrock. The gravel breasts are carried 50 to 60 ft. wide, and 5 ft. high, requiring very little timbering; ventilation is obtained through connection with old works. Three carloads of 1,500 lbs. each are taken out daily per man. The dump carries 1,000 carloads; washing being done once a week through 12 sluices set on a 16 in. grade, paved with slat and cross riffles. The wash water is obtained from the mines, using an old tunnel for a reservoir. The gold on the bedrock is coarse, and sells for $18 per ounce. D. C. Webster, of Georgetown, owner.

Greenstone Mine (Quartz).—It is 2 miles E. of Shingle Springs. A considerable amount of work has been done here, as shown by several shafts; these were sunk in the serpentine. As no vein appears on the surface, the character of the ledge could not be ascertained. H. Barnes and L. L. Robinson, of Shingle Springs, owners.

Griffith Mine (Quartz).—See our VIIIth and Xth Reports, pp. 189 and 172. Idle.

Griffith & Bryant Consolidated Mine (Quartz).—It is in Sec. 30, T. 10 N., R. 11 E., one mile E. from Diamond Springs, and embraces 3,000 by 600 ft. The vein, 2 to 3 ft. wide, courses N. and S. A 140 ft. shaft on the vein has been drifted on to the N., and 50 ft. stoped. A 5-stamp "prospecting" mill, with 350 lb. stamps, driven by an 8 ft. "hurdy," under 60 ft. pressure, is part of the plant. C. F. Bryant, of Diamond Springs, owner.

Grizzly Bear Mine (Quartz).—See our XIth Report, p. 201.

Grizzly Flat Mine (Drift and Hydraulic).—This is in T. 13 N., R. 11 E., one half mile S.W. from Volcanoville, and contains 160 acres at the head of Grizzly Flat. A part of the surface has been hydraulicked,

showing the channel to have a N.E. and S.W. course. Tunnels have been driven into the hill to cut the channel, but so far without reaching it. Barklage Estate, of Greenwood, owners.

Gross Mine (Quartz).—See our VIIIth Report, p. 181. Idle.

Grouse Gulch Mine (Quartz).—It is 1½ miles W. of Grizzly Flat, on Grouse Gulch, and contains 1,500 by 600 ft. The vein courses N. and S., and dips 60° W., between syenite walls, varying in width from 6 in. to 5 ft. The ore is spotted; the narrower the vein the better the quality. A 100 ft. shaft is intersected at a depth of 60 ft. by a drain tunnel 200 ft. long. There is a second shaft higher up, 80 ft. deep, with a 50 ft. drift. No. 1 shaft has a 40 horse-power hoisting engine with a 6 in. Cornish pump. A third intermediate shaft is 50 ft. deep, from which good milling ore was obtained. See our VIIIth Report, p. 178. Mrs. K. Hoskins, of Grizzly Flat, owner.

Halleck Mine (Quartz).—See True Consolidated.

Harmon Mine, Young and Old (Quartz).—See True Consolidated.

Havilah Mine (Quartz).—See Nashville Mine.

Hendy Mine (Quartz).—See Nashville Mine.

Henrietta Mine (Quartz).—See our VIIIth Report, p. 186. Idle.

Hope Mine (Placer).—N.E. of Volcanoville. See our XIth Report, p. 206.

Ibid Mine (Quartz).—It is 1 mile S. of Grizzly Flat, in T. 9 N., R. 13 E. It is the southerly extension of the Mt. Pleasant Mine, 1,500 by 600 ft., and patented. C. W. Watts and T. D. Crocker, of San Francisco and Ohio, owners.

Ida Mine (Quartz).—Idle. See our VIIIth Report, p. 182.

Idlewild (Taylor) Mine (Quartz).—See our VIIIth, Xth, and XIth Reports. It is 1½ miles E. of Greenwood, on the "Mother Lode." The present workings are below the 600 ft. level, and since our last report the electric pumps have been replaced by others worked by compressed air, and the mill enlarged to 40 stamps. As the mine is troubled with swelling ground, the management have found it advisable to fill in the old stopes as much as possible, and for this purpose a chute has been opened to the surface, through which material dug from the surface is dropped, besides using the waste from the mine for the same purpose. In making the change to pumps run by compressed air, considerable annoyance was caused by their freezing up in less than thirty minutes after starting; this was remedied by introducing a small jet of water into the pipe above the suction.

The mill has 40 stamps of 950 lbs. weight, dropping 104 times per minute, using 4 in. chrome steel shoes and dies, that have an average life of 105 days, with a duty of 110 tons in twenty-four hours. The apron plate area is 52 in. by 16 ft., set at an angle of 1¾ in. to 1 ft. The plates are dressed every day, but only scraped once a month; 38 per cent of the total yield of amalgam is taken from them, which might be increased if scraped oftener. The ore at present carries about 3 per cent sulphurets, saved on 8 Woodbury concentrators; a chlorination plant for working them is in contemplation. The power is derived from 45 in. and 6 ft. Dodd's wheels for mill and compressor; the latter to run five drills and the pumps. Electric lights are used all over the establishment. The ore carries considerable slate inclosed. Seventy-five men are employed; 50 underground. E. W. Chapman, of Georgetown, owner.

Indian Creek Land and Mining Company's (Shaw) Mine (Quartz).—This property has been described in our VIIIth and Xth Reports, pp. 193 and 181, and is situated 2½ miles W. of El Dorado, in T. 10 N., R. 10 E. It is 3,660 by 600 ft. on the west porphyry belt. The present company have a vertical shaft on the W. wall, taking their drift 8 ft. wide. It is from this part of the mine that their best pay rock is obtained. A drift is being run from a point 75 ft. deep in the 135 ft. vertical shaft on the E. wall. With large reduction works, the whole width between the walls (140 ft.) would pay to crush, but the capacity of the company's 5 ft. Huntington roller mill being 25 tons in twenty-four hours, only the higher grade quartz can be worked. The mill is supplied with 75 sq. ft. of plates and two Woodbury concentrators, that handle the 1½ to 3 per cent of sulphurets contained in the ore. A 12 horse-power steam engine is used, but water power under 135 ft. pressure could be obtained from the Crawford ditch. Very little timbering is required for the mine, and no artificial ventilation.

This deposit is one of the most peculiar and interesting to be found in the county. A dike of feldspar porphyry, 140 ft. wide at the mine, but narrowing from this point, can be traced for over 2 miles in a N. and S. direction, inclosed in black slate. The gold occurs mostly in a crushed zone on each side of this dike, although traces of the metal can be found over nearly its whole extent. In these crushed zones the original porphyry is more or less completely replaced by quartz, stringers of which extend in toward the center of the dike in a horizontal position. The stringers also extend out into the slates, but in the latter case they are vertical. The pure quartz is usually quite porous. Those portions of the dike where the replacement is not complete and which are filled with sulphurets, very closely resemble the ore of the Big Cañon Mine. Although gold in paying quantities is found nearly everywhere along the crushed zones, yet there are also many rich pockets. Much surface work has been done along the edges of this dike for half a mile N. and a mile and a half S. Indian Creek Land and Mining Company, owners; D. W. C. Morgan, of El Dorado, Superintendent.

Inez (Central) Mine (Quartz).—This property is situated 8 miles S. of El Dorado, in T. 8 N., R. 10 E., and is now idle. It is 1,500 by 600 ft. The vein strikes a little W. of N. on the east side of the main "Mother Lode" belt, and dips E. about 60°. Hanging-wall is slate, foot-wall is decomposed. A shaft has been sunk 250 ft. and is supplied with steam hoist. See our Xth Report, p. 171. Inez Gold Mining Company, owners; J. C. Healds, of Nashville, Superintendent.

Ivanhoe Mine (Quartz).—See our Xth Report, p. 175. It is said that this property will soon resume active work.

Jerusalem Mine (Hydraulic).—This property is situated 1¼ miles E. of Placerville, where they are working a bench of gravel with three men. It is largely prospecting. — Alderson, of Placerville, owner.

Josephine Mine (Quartz).—See our VIIIth Report, p. 165. It is situated in Volcanoville, in T. 13 N., R. 11 E. It is idle. J. W. McCall et al., of Nevada City, owners.

Kates (Norris) Mine (Drift).—This property was formerly a part of the Mount Hope claim, and is situated 1½ miles E. of Volcanoville; it contains 80 acres facing on a ridge running down to the river. It was formerly worked as a hydraulic claim. The channel runs E. and W. Parts of this channel are eroded, only showing across the spurs that

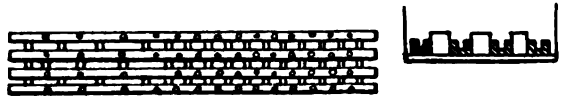
run N. and S. down the river. A tunnel has been driven S.W. for 250 ft. in the bedrock, then a 14 ft. upraise made into the channel. The gravel is strongly cemented, necessitating the use of stamps for reduction. The gangway is being extended 100 ft. S. P. Kates et al., of Georgetown, owners.

Kentucky Flat Gravel Mine (Drift).—This property is in Sec. 22, T. 13 N., R. 11 E., 9 miles E. of Georgetown, and contains 154 acres. The channel courses N. 30° W., which is also the course of the main tunnel, extending 650 ft. From this tunnel an 18 ft. upraise breaks into the gravel, in which a drift has been extended for 700 ft. in length, from which openings have been made in gravel to the N. 150 ft., to the W. 80 ft., and to the E. 25 ft. The gangway is carried 6 ft. high, and the gravel is drifted from 3 to 5 ft. in depth. The gravel is mostly quartz of a deep blue color; some of the bowlders being over 9 ft. in length and breadth; the whole is slightly cemented. The altitude of the bedrock is 3,130 ft. Just above the gravel is a layer of hard sand from 3 to 4 ft. thick, between which and the cement, logs, charcoal, and petrified wood are frequently found. The bedrock tunnel is only partially timbered, and no artificial ventilation is required. Little water comes from the gravel; the wash water is obtained free from the neighboring gulches; the washing being effected through seven or eight boxes supplied with slat and block riffles. A second body of gravel of a gray color has been uncovered parallel to the blue, but on a higher bench. The bedrock is slate and serpentine; the gold is coarse and is .910 fine. A. J. Wilton, of Georgetown, owner.

Knob Hill Mine (Quartz).—In past years this mine was actively worked, but at present it is idle. It lies on the N. side of Agra Mountain.

La Moille Mine (Quartz).—This property is situated at Logtown, 3 miles S. of Mud Springs, and comprises 1,500 by 600 ft. It carries a number of quartz seams in granite, with a general N. and S. course. H. Sutliffe, of Mud Springs, owner.

Linden Mine (Drift).—See our VIIIth Report, p. 196. They have three claims, comprising 300 acres, known as Cedar Springs, Linden, and Globe claims. The present work of drifting on this gravel deposit is carried on through a bedrock tunnel running S. of E. 4,000 ft., which crosses a 500 ft. channel below the tunnel level, and continuing, cuts the channel again, showing a horseshoe bend. The gravel breasts are carried 30 ft., and from 2½ to 8 ft. deep, timbered with square sets and



RIFFLE USED AT LINDEN MINE, EL DORADO CO.

lagged. The main drift is timbered with 6 ft. posts and 3½ ft. caps, in the clear. The ventilation is through an air shaft 90 ft. deep, and air gangways. The channel is capped with lava about 120 ft. thick. The company employs 23 men on two shifts, taking out 40 carloads per day. The gravel is run through a 10-stamp mill, being somewhat cemented, and carrying a large proportion of clay; hence the use of 8 in. of water through the battery. The stamps are light, being 500 lbs., drop-

ping 105 times per minute, with a 7 in. drop. The battery has a double discharge, using wire screens, 16 holes to the square inch; the apron is provided with four grooves. The pulp passes into sluices provided with slat riffles, with alternating small, projecting blocks between the slats. In the slats, between the projection, auger holes are bored, the current thus receiving a serpentine course; 400 feet of sluices are provided. No regular time is set for cleaning up the boxes; it depends entirely on the accumulation of amalgam. The mill puts through 75 carloads per day, weighing 1,800 lbs. each. Linden Gold Mining Company, of Placerville, owners; J. M. Brown, Superintendent.

Little Chief Mine (Placer).—It is on Cañon Creek above Georgia Slide, on the porphyry seam belt. Two tunnels are run, 130 ft. and 240 ft. long, and upraises made on the seams. A one-stamp Kendall mill, run by 4 ft. Pelton wheel, with 5 in. of water under a 100 ft. head, crushes the quartz out of the seams. Most of the seams pitch to the S. Beattie Bros., of Georgetown, owners.

Live Oak Mine (Quartz).—This is an undeveloped property. It lies about 1½ miles S. of the Big Cañon Mine. The ore body has an exposed width of 200 ft., and in general character much resembles the latter mine. It lies between massive greenstone and slate.

Log Cabin Mine (Quartz).—It is in Sec. 30, T. 9 N., R. 10 E., about 5 miles S. of Shingle Springs, and is 1,500 by 600 ft. The vein strikes S.E. and N.W., dipping to the N. between slate walls 4 ft. apart. Two tunnels have been run by the owner to cut the ledge, without yet reaching it. No. 1, 65 ft. below the croppings, is 130 ft. long, and No. 2, 35 ft. lower, is 170 ft. long; both on S.W. course. Worked by the owner alone. J. Darrow, of Shingle Springs, owner.

Lone Jack Mine (Quartz).—See our Xth Report, p. 176. It is in Sec. 28, T. 12 N., R. 10 E. Steam hoist on a shaft 400 ft. deep. Ledge about 24 ft. wide.

Lone Star Mine (Quartz).—This property is situated 2 miles E. of Diamond Springs. It is 1,500 by 600 ft., with a vein from 4 to 5 ft. wide, running N.W. and S.E. between slate walls, decomposed next to the vein. The quartz forms in lenticular or kidney-shaped masses in the vein; dip nearly vertical. A tunnel has been started on Bangor Gulch about 600 ft. E. of the main quartz belt. A. Latourrette, J. B. Lawton, and A. Tirre, of Diamond Springs, owners.

Lone Star Mine (Quartz).—It is in Big Cañon, in T. 8 N., R. 10 E., 1¼ miles S. of Nashville; it is 1,500 by 600 ft. The vein strikes N. and S. and dips E. about 60°. The walls are slate, with a heavy gouge 1 ft. wide on the foot-wall. A shaft has been sunk 100 ft. deep and a drift run S. about 100 ft. on a 7 ft. ledge of ribbon quartz carrying about 0.5 per cent of sulphurets. The hoisting is done with a windlass. A 5 ft. Huntington mill, run by steam, crushes from 12 to 14 tons per day, consuming one cord of wood, costing $4. J. C. Heald, of Nashville, owner.

Lookout Mine (Quartz).—This property is in T. 13 N., R. 11 E., in Quartz Cañon, near Volcanoville. The claim is 4,500 by 600 ft. The vein lies between slate walls, with an average width of 2 ft. A cross-cut tunnel running for the ledge has been driven 200 ft. W. Cary, of Georgetown, owner.

McCall Gravel Mine (Drift).—It is 3 miles N.E. of Volcanoville, on the S. side of the Middle Fork of the American River. It is a bench of

50 ft. above the present river level, that has been worked since the early '50s. It carries regular river-wash and channel gold. A slate bedrock tunnel 300 ft. in length runs under the gravel, which is free, requiring square sets in breasting out, using 5 ft. posts. The gold is worth $18 per ounce. T. McCall, of Michigan Bluff, owner.

McNulty (Oakland) Mine (Quartz).—It is in T. 9 N., R. 10 E., 4 miles S. of El Dorado, and contains 80 acres. The vein courses N. and S.; dips E. about 60°, and is 6 ft. wide, with a slate hanging- and greenstone foot-wall. The main tunnel is 300 ft. long, and the shaft is sunk 600 ft. below it, the hoisting power being furnished by a Knight wheel in the tunnel, with water from the Crawford ditch. J. B. Drury, of St. Louis, Mo., owner.

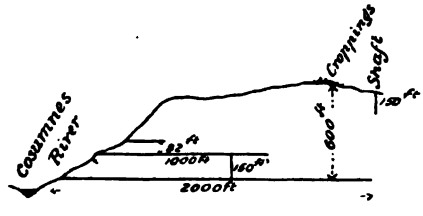
Madrona Mine (Quartz).—It is in Sec. 29, T. 12 N., R. 10 E. Shaft 40 ft. deep. Vein of unknown width and low grade, but carries a large percentage of sulphurets, and is inclosed in slate walls.

Mammoth Mine (Quartz).—See our VIIIth Report, p. 186.

Manzanita Queen Mine (Quartz).—See our VIIIth and Xth Reports, pp. 189 and 172.

Mathenas Creek Mine (Quartz).—See our VIIIth and Xth Reports, pp. 190 and 172. The company owns half a mile on the course of the ledge, one quarter mile wide, that lies just W. of the "Mother Lode." The course of the vein is N. 20° W., and dips 55° to the E., and is from 2 to 8 ft. wide between slate walls. A tunnel is being driven from near the creek to cut two veins that crop out on the surface, at a depth of 300 ft. The ground requires but little timbering. The main vein carries 0.75 per cent of sulphurets, assaying several hundred dollars per ton. The mill (Huntington) stands at the junction of Stone and Mathenas creeks, 100 yds. W. of the tunnel. Four men are employed. Sacramento Development Company, owners; R. T. Morrison, of El Dorado, Superintendent.

Melton Mine (Quartz).—See our VIIIth Report, p. 177. It is 2½ miles S.E. of Grizzly Flat, and is being reopened after an idleness of six years. There are three claims of 1,500 by 600 ft., each carrying a N. and S. vein,



SECTION OF MELTON MINE, ELDORADO CO.

with a slight dip to the W. and an E. and W. vein dipping N. The country rock is a syenite. Aside from the old plant it is proposed to build a 3-ton chlorination plant to work the sulphurets. L. L. Lamborn, of Grizzly Flat, owner.

Miller Mine (Quartz).—See our VIIIth and Xth Reports, pp. 189 and 172.

Mississippi Mine (Drift).—It is 1½ miles E. of Volcanoville, between the Kates and Gray Eagle claims. It contains 80 acres. A bedrock tunnel is run 240 ft. in the W. side of the spur; the others have been run

from the E. In this claim a top layer of free gravel is being worked; the bottom (channel) gravel, which is cemented, has not been touched. C. F. Lloyd, of Georgetown, owner.

Montezuma Mine (Quartz).—This property is in T. 8 N., R. 10 E. It controls 1,500 by 600 ft. on the main "Mother Lode," opposite Nashville. The vein on the S. end is 12 ft. wide, between slate walls; going N. this reduces to about 6 ft. The ribbon quartz carries about 1 per cent of sulphurets. A shaft has been sunk on the vein about 350 ft.; the mouth at present is caved. A new shaft has reached a depth of 160 ft., and is supplied with a steam hoist and a Dow pump, consuming one cord of wood per day. About 60 feet of drift have been run S. from the new shaft. There is a 10-stamp (650 lbs.) mill, with aprons 5 by 6 ft.; 4 sluice plates 15 ft. long by 16 in. wide, set on a grade of 1½ in. to the foot. Also 20 ft. of blanket sluices. The quartz is variable, ranging from $2 50 to $15 per ton. The mill is run by free water, acting through 2 miles of ditch. J. C. Heald, of Nashville, owner.

Mooney Mine (Drift).—Is 8 miles E. of Placerville. Active development commenced in summer of 1894.

Morey Mine (Quartz).—This property is situated on Humbug Flat, 1 mile W. from Grizzly Flat. There are two claims in the property, one showing an N. and S. vein; the other with an E. and W. one. The former dips nearly vertical, the latter to the N. The veins are in syenite and have an average width of 2 ft. The quartz is of good grade, carrying lead, iron, and zinc sulphurets. The property is opened through tunnels and a shaft. On the N. and S. vein the tunnel has a length of 300 ft., and on the E. and W. vein 400 ft. The shaft is down 125 ft., or 50 ft. below the tunnel level. The ore between the tunnel and the surface has been stoped. A small 5-stamp mill, with 600 lb. stamps, is worked by a Knight wheel under 100 ft. pressure; the water (60 in.) is supplied from the Eagle ditch, at a cost of $1 per twenty-four hours. The apron plate is 4 by 6 ft., set on a grade of 1¾ in. to the foot. The duty per stamp, when using a No. 40 punched screen, at 90 drops per minute, is 1¼ tons. Half the amalgam is saved in the battery, which is provided with an inside plate. The aprons are scraped two or three times in twenty-four hours. The gold is worth $13 per ounce. See our VIIIth and Xth Reports, pp. 178 and 178. E. R. Morey, of Grizzly Flat, owner.

Morse Mine (Quartz).—This mine is located 3 miles E. of Latrobe, on the W. side of a large body of serpentine which crosses Big Cañon and extends S. to the Cosumnes River. An incline shaft has been sunk here and the hoisting works still remain, but nothing could be learned as to the extent and character of the ore.

Mount Hope Mine (Drift).—See Kates Mine.

Mount Pleasant Mine (Quartz).—It is three fourths of a mile W. from Grizzly Flat. The company controls one mile on the vein, which strikes N. and S. in syenite, with a width of from 2 to 6 ft. The old workings extend down 700 ft.; these are filled with water to the drain tunnel level, which cuts the shaft 125 ft. below the surface. Two known ore shoots have a southerly pitch. A 10-stamp mill (originally 20), run by steam power, with 4 Frue concentrators, is idle. See our VIIIth and Xth Reports, pp. 178 and 178. Mount Pleasant Gold Mining Company, owners; L. Missmore, Superintendent.

Murzo Mine (*Brass's Claim*) (Drift).—This property is on Buckeye Hill, on Middle Fork of American River, in T. 13 N., R. 10 E., 2 miles from Volcanoville, and contains 30 acres. A tunnel has been run 150 ft. through the slate rimrock, showing the bedrock to be pitching away. A second lower one has been started, with three men working. This claim is adjoining, and working on the same channel as the Buckeye Hill gravel claim. A. E. Brass, of Georgetown, owner.

Nashville (*Havilah or Hendy*) *Mine* (Quartz).—It is situated at Nashville, in T. 8 N., R. 10 E. The works, which were very extensive, were established on a large quartz cropping on the "Mother Lode"; it contains 1,500 by 600 ft. The shaft is said to be 650 ft. deep, and at 200 ft. depth the characteristic black gouge of the vein is given as 12 ft. wide. The mine has not been worked for eight years, but is now (September, 1894) being rehabilitated by an English company. Joshua Hendy Machine Works, of San Francisco, owners.

New El Dorado Mine (Quartz).—It is 2½ miles N. from Greenwood, and contains 1,500 by 600 ft. It is the north extension of the Cedarberg Mine. The vein strikes N. and S. and dips E. It carries specimens of very coarse gold, and has been opened by a tunnel. W. N. Martin, of Oakland, owner.

Oak Mine (Quartz).—It is 5 miles S.W. of Grizzly Flat. The claim is 3,000 by 600 ft. The vein, from 1 to 4 ft. wide, courses N.E. and S.W., dipping W. at an angle of 75°, between granite walls. The quartz carries considerable sulphurets. The main tunnel runs on the vein 400 ft.; another on a higher level is driven 150 ft., and from this to the surface the ground is stoped out. A 5-stamp water power mill, with 800 lb. stamps, and a 16 ft. buddle, crush and concentrate the ore. J. Ryan, of Grizzly Flat, owner.

Ohio Mine (Quartz).—It is 1 mile S.W. from Grizzly Flat, in T. 9 N., R. 13 E. The claim is 1,500 by 600 ft., and forms the south extension of the Mount Pleasant Mine. The vein averages about 4 ft. in width. Two shafts have been sunk on the vein; an inclined and a vertical one; the latter is 135 ft. deep. An ore shoot from the Mount Pleasant ground pitching S. has been worked for several hundred feet in length on the Ohio ground to a depth of 50 ft. The ore is said to have milled $12 per ton, though there are spots in the vein rated at $60, exclusive of the sulphurets, of which there is about 1 per cent, assaying from $60 to $200 per ton. On Steely's Fork of the Cosumnes River is a 5-acre millsite belonging to the property.

Ohio Mine (Quartz).—This property is half a mile from Greenwood, in Georgetown District. The claim consists of 1,200 by 600 ft., on a 4 ft. vein coursing a little N. and W., with a northerly dip between slate walls. The developments consist of open cuts and surface washings. S. Kaiser, of Greenwood, owner.

Old Gray Mine (Quartz).—It is in T. 10 N., R. 9 E., 3 miles N.W. from Shingle Springs, and is 2,000 by 600 ft. The vein runs E. and W.; dips N. about 45°, and is from 1 in. to 3 ft. wide. It is a pocket vein, and is on the edge of a great body of gabbro. There is a shaft 100 ft. deep, with a short drift on the pay shoot, where the vein is 3 ft. wide. D. C. Hodgkins, of San Francisco, owner.

Oregon Mine (Quartz).—See our VIIIth Report, p. 182. North extension of the Rose.

Oriflamme Mine (Quartz).—See our VIIIth and Xth Reports, pp. 189 and 172.

Oro Fino Mine (Quartz).—See Big Cañon Mine.

Pacific Mine (Quartz).—See our VIIIth, Xth, and XIth Reports, pp. 183, 173, and 203. It is situated in Placerville. Abandoned.

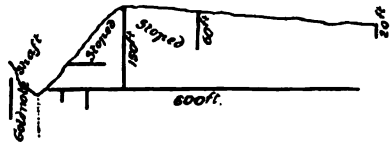
Pacific Mine (Placer).—This property is situated near Georgia Slide, on Cañon Creek, in T. 12 N., R. 10 E. It contains between 6 and 7 acres on the porphyry seam belt. The workings consist of an open cut; the banks being blasted down and the entire mass washed through a long line of sluices with block riffles. Barklage Estate et al., of Georgetown, owners.

Padre Mine (Quartz).—It is 2½ miles N. from Nashville, in T. 8 N., R. 10 E., and is 1,500 by 600 ft. on the "Mother Lode"; the quartz is 5 ft. in width. A shaft on the vein is 160 ft. deep, supplied with water-power hoist, using a home-made wheel under 23 ft. head. A 5-stamp mill, with 650 lb. stamps, run by water power, belongs to the property. Not working. J. M. Vandergrift, of Nashville, owner.

Parson Mine (Seam).—See our XIth Report, p. 203.

Payne Gravel Claim (Drift).—It is in T. 9 N., R. 13 E., 3 miles S. of Grizzly Flat, and consists of 50 acres south of Clear Creek. It is capped with 40 ft. of lava; pay gravel from 1 to 3 ft. deep on slate bedrock; the gold is coarse. A tunnel started in the gravel has been driven 200 ft. No breasting has been done yet. The drift is timbered with 6 ft. 4 in. posts and 3 ft. 6 in. caps, in the clear, and with a 5 ft. spread. Wash-water is obtained from Clear Creek. There is a bedrock race and six flume boxes for washing, using slat riffles. A clean-up is made twice a year. The channel has a S.E. and N.W. course; its width has not been ascertained. J. M. McClean, of Grizzly Flat, owner.

Philadelphia and Gold Note Mine (Quartz).—It is 8 miles S. of Grizzly Flat, in T. 8 N., R. 18 E. It lies at an elevation of nearly 4,000 ft. above sea-level, and is 2,900 by 600 ft. The course of the vein is N. 30° W., with an easterly dip at an angle of about 60°; the average width between walls is 4 ft. The hanging-wall is a micaceous slate; the foot-wall talcose, with a black gouge, from 1 to 2 ft. wide. Two shafts have been sunk, one 150 ft. and the other 60 ft. deep. A tunnel 600 ft. long connects with the deeper shaft; below are two winzes, 17 ft. and 35 ft. deep; the former 25 ft. and the latter 75 ft. from the mouth of the tunnel. The ore shoot is 600 ft. long, and about 100 ft. have been stoped; the pitch appears to be to the N. The property is well supplied with water and timber; lumber is procured from Tower's mill, 12 miles distant, at a cost of $10 per 1,000 ft. Not more than a miner's inch of water issues from the tunnel. The quartz has a ribbon structure, carrying about 2½ per cent of sulphurets, mostly iron, with some galena; they are said to assay from $20 to $300 per ton. The ore is reduced in a 10-stamp mill with 650 lb. stamps. The stamps make 87 drops per minute, starting with 4 in. drop with new shoes and dies, and increasing with the wear of the shoes and dies to 7 in.; the discharge varies from 2 to 7 in. high. Three quarters of a ton is crushed per stamp through



SECTION OF GOLD NOTE & PHILADELPHIA MINES, ELDORADO CO.

a No. 40 tin screen. Cast-iron shoes and dies are used. The aprons are 4 by 4 ft.; the sluice plates (double) 12 ft. long and 14 in. wide, all set on an angle of 2 in. to the foot. The feeding is done by hand. The tailings are concentrated on a 16 ft. buddle. The mill is run by water power; the water is from the Plymouth Company's ditch, and applied to a 8 ft. home-made "hurdy" wheel. Polk, Parker Bros. & Chapman, of Omo Ranch, owners.

Pine Hill Mine (Quartz).—It lies one half mile to the E. of the Pyramid, on an E. and W. vein. The formation is much the same as at the Pyramid.

Pine Hill Gold Mining Company's Mine (Quartz).—Its property is 6 miles N. from Shingle Springs, and is 3,000 ft. in length on an E. and W. vein, by 300 ft. in width. The vein is 30 ft. wide, between slate walls, and carries 5 per cent of sulphurets (iron, lead, zinc, and copper). An incline is sunk on the vein about 30 ft., and a cross-cut started for the hanging-wall; at present it is in 30 ft. and has not reached the wall. Pine Hill Gold Mining Company, owners; C. Milly, of Shingle Springs, President.

Pleasant Valley Gravel Channel.—A rich channel of drift gravel was discovered in the fall of 1893, running E. and W. under Pleasant Valley, 10 miles E. of Placerville. It is covered by the ranches of John Fink and N. Avansino, and is about 60 ft. beneath the surface. Dimensions and richness undetermined. Is being actively prospected. An 8-stamp mill is being erected by Mr. Fink.

Pocahontas Mine (Quartz).—It is 2 miles S. from El Dorado. It is 1,500 by 600 ft. on a N.W. and S.E. vein, which is 4 ft. wide, with an easterly dip, on the contact of granite and slate; the latter makes the hanging-wall. To resume soon.

Pyramid Mine (Quartz).—This mine, the property of the Pine Hill Gold and Silver Mining Company, is situated 5 miles N. of Shingle Springs. The claim lies on a hill from the summit of which rises a great body of quartz. Before being blasted off this mass of quartz extended fully 25 ft. into the air. Several veins unite to form this "blowout," as the miners term it, in the center of the claim. The main vein does not extend far S., but can be traced several miles to the N. Much of the quartz is white and massive. The ore is rather base, carrying a little galena with arsenical, copper, and iron pyrites. The gold is partly contained in these sulphurets and partly free. The inclosing walls are talcose schist. A small amount of mariposite is found in the lower workings. The same company owns the Unity, the extension of this claim on the N. A method of roasting the ore has lately been undertaken here, so as to save a greater proportion of the gold, but it has not yet been very successful.

The mine is opened by a tunnel 300 ft. long on the vein, giving about 100 ft. backs; 135 ft. from the tunnel mouth a shaft 100 ft. deep has been sunk and a drift run N. 140 ft. on the pay shoot.

The shaft is provided with a fan ventilator and steam hoist (30 horsepower). The tunnel track is iron "T" rails, 12 lbs. to the foot. A 5-stamp steam mill with 750 lb. stamps and two Frue concentrators, arranged to run by water part of the year, reduces ore. The mine makes 2,000 gallons of water per day, which is hoisted to the tunnel level. The course of the vein is N. 27° E. Pyramid Mill and Mining Company, owners; W. H. Harvey, of Shingle Springs, Superintendent.

Rattler Mine (Quartz).—It is 2½ miles S. from Placerville, in T. 10 N., R. 11 E., and is a small claim of 900 by 300 ft., supposed to be on the same vein as the Epley, on the opposite side of Weber Creek; it has two tunnels. John Dench and James Keyser, of Placerville, owners.

Red Rover Gold Mine (Quartz).—It is 3 miles S.E. of El Dorado, in T. 10 N., R. 9 E. It is 1,500 by 600 ft., on a N. and S. vein, from 6 in. to 3 ft. wide, dipping N. 60° E., with granite hanging- and slate foot-wall. Two shafts are sunk on the vein, 130 ft. and 30 ft. deep, and 75 ft. apart, with drifts 85 ft. to the N. and 30 ft. to the S. E. Harper et al., of El Dorado, owners.

Revenge Claim (Quartz).—This property is situated in T. 13 N., R. 9 E., 1 mile S. of Greenwood. Idle. J. Cheney, of Philadelphia, owner.

Ribbon Rock Mine (Quartz).—It is in Sec. 20, T. 10 N., R. 11 E., 2½ miles S.E. of Placerville, in Scott's Ravine, and is 1,500 by 600 ft., on a 4 ft. vein between slate walls running N. 12° W., with a dip to the E. of 65°. This is supposed to be on the main "Mother Lode." Two shallow shafts, 23 and 36 ft., show a good vein, with heavy gouge on the foot-wall. The quartz is of ribbon structure, and carries about 1 per cent of sulphurets. M. Miller, of Placerville, owner.

Rocky Bar Claim (Quartz).—It is half a mile E. of Greenwood, and is 1,500 by 600 feet on a N.W. vein, about 1 ft. wide between slate walls, and has an easterly dip of about 60°. Two shafts (now caved) have been sunk, the deepest said to be 45 ft. Also an extended cut has been made along the croppings. The slate next to the walls is well mineralized. S. Kaiser, of Greenwood, owner.

Rodgers' Mine (Drift).—See Benfield.

Rose Mine (Quartz)—See our VIIIth Report, p. 182. It lies in the slate, W. of the Pacific Mine, at Placerville.

Rosencranz Mine (Quartz).—See our VIIIth and Xth Reports, pp. 171 and 176.

San Martine Gold Mine (Quartz).—It is 1½ miles N. of Greenwood, and is 1,500 by 600 ft. The veins, which lie in the slate near the serpentine, run N.W. These small quartz seams are being sunk upon. An incline of 23 ft., sunk on a veinlet from 1 to 6 in. wide, yields rich in places; the rock is worked in a 9 ft. "hurdy," under a 20 ft. head, requiring 10 in. of water. E. Hummel, of Greenwood, owner.

Santa Rosa Mining Claim (Drift).—This property is situated on Hopkins Creek, near Volcanoville, and controls 480 acres of ground. A bedrock tunnel is being driven by two men, and at present is 713 ft. in length. From this an upraise for air will be made into the old Bunker Hill channel, which crosses the course of the tunnel at nearly right angles. The channel that the tunnel is designed to tap lies about 1,000 feet farther back in the hill. The bedrock is hard slate, requiring no timbering. A blower run by a small Turk wheel, 16 in. in diameter, is used to clear the tunnel of smoke. Water power is derived from springs near by. Santa Rosa Drift Mining Company, owners; G. A. Tupper, of Santa Rosa, Secretary.

Schleifer Mine (Quartz).—This mine is on the E. side of Big Cañon, 7 miles S. of Shingle Springs. A ledge was opened here for iron, but the quality proved too poor. The only mineral to be found around the old workings is a base sulphide ore, said to carry some gold. The country rock is much broken up by bunches of porphyry.

Sharp Mine (Quartz).—See our VIIIth Report, p. 194. A 10-stamp mill was erected in 1890 and run a short time. Now idle.

Shaw Mine (Quartz).—See Indian Creek Land and Mining Company.

Slager Mine (Quartz).—This property is situated 4 miles N. of Greenwood, and has 600 by 600 ft. of patented ground; the remainder of the claim is held by possessory right. The vein, about 20 ft. wide between slate walls, talcose on the foot, is on the course of the "Mother Lode," with a N.W. course and an easterly dip. The developments consist of a tunnel 500 ft. long; the tunnel taps a shaft 250 ft. deep. In and above the tunnel, on the pay shoot, for 300 ft. in length, the vein has been stoped to the surface. John Wade et al., of Oakland, owners.

Spanish Mine (Hydraulic).—This property is situated half a mile N.W. from Greenwood, and is on the "seam" belt; the claim has 1,500 by 600 ft. of patented ground. Eruptive dikes traverse the slate bedrock, and numerous quartz seams penetrate the slate. In all of the different varieties of rock gold has been found; among these, besides different slates, were amygdaloidal porphyritic rocks, clays, and quartz. The larger body of quartz (broken up) crosses the pit between slate walls. A shaft was sunk on this 45 ft. and yielded considerable gold. The whole has been worked by hydraulic process, but at present two men are working on the seams, panning out the quartz. M. M. Howe, of Greenwood, owner.

Springfield Mine (Quartz).—See our VIth Report (Part II).

Staples Claim (Quartz).—It is situated in Logtown, 2½ miles S. of El Dorado. It is 1,500 by 600 ft. Prospecting on small quartz stringers in the granite.

Standard Pocket Mine (Quartz).—It is a quarter of a mile N. from Coloma, across the South Fork of the American River, and is 1,500 by 600 ft. It belongs in the seam diggings belt near the contact of slate with granite. The course is N.W. A tunnel has been driven 230 ft. The seams run 2 to 12 in. in width, and all carry more or less gold. Idle. C. Schulze and G. Patrick, of Coloma, owners.

Starlight Mine (Quartz).—This property is situated in T. 9 N., R. 10 E., 2 miles S. of El Dorado, and W. of Logtown, and is 500 by 600 ft. The vein courses N., dipping E. about 40°. There are three shafts sunk on the vein; the most northerly is about 160 ft. deep; 300 ft. to the south is a second (incline) shaft, about 175 ft. deep, which is tapped near the bottom by a tunnel over 500 ft. long, running on the vein; still 300 ft. farther south is a shaft 350 ft. deep, which is tapped by a tunnel 160 ft. long, and has a drift 110 ft. Drifts and cross-cuts have been run at the 60 ft. level, 100 ft., 160 ft., and 270 ft. long. The present workings are being carried on to the north of the middle shaft. Starlight Mining Company, owners; A. Blanc, of El Dorado, Superintendent.

Stewart Mine (Drift).—See Xth Report, p. 180. It is 1½ miles S.E. of Placerville, between Chili Ravine and Weber Creek. It is provided with a 10-stamp double-discharge mill. It has been worked intermittently for years with indifferent success. Recently some rich gravel was struck and its future is brighter. John Melton, of Placerville, owner.

St. Lawrence Mine (Quartz).—Seven miles N. of Placerville. See our XIth Report, p. 202. Myerson & Alderson, of Placerville, owners.

St. Lawrence (Stillwagon) Mine (Quartz).—This property is situated 7 miles W. of Fairplay. It comprises two claims, each 1,500 by 600 ft. The vein, from 2 to 3 ft. wide, between granite walls, has a N.E. strike

and dip to the S. The quartz carries a large per cent of sulphurets. Both claims are opened by tunnels on the ledge. No. 1, or the Still-wagon, has a 400 ft. tunnel, and No. 2, the extension, has a 200 ft. tunnel. On the former a little stoping has been done. A 5-stamp mill, to be run by water power, is being built; using 850 lb. stamps and a Woodbury concentrator. The motive power is a 6 ft. Knight wheel, worked under a 70 ft. head. The compressor, for one Burleigh drill, is run by a 4 ft. Knight wheel. The company own their own power; 250 miner's inches are taken from the Little South Fork of the Cosumnes River through three quarters of a mile of ditch. A blower will be put on for ventilation. Apron plates are 4 by 6 ft., with a grade of 1 in. to the foot. Timber is abundant on the ground. Freight to the mine from Placerville is 50 cents per cental. See our Xth Report, p. 178. S. A. Laine, of Grizzly Flat, owner.

Stuckslager Mine (Quartz).—It is situated on Granite Creek, 1 mile S.W. of Lotus or Uniontown. This claim is noteworthy for the presence of roscoelite, a very rare mineral, with the gold; this mineral was first discovered here. The vein is about 1 ft. wide, and has a N.E. course, dipping southerly about 60°. The fissure is near the contact of the granite and the serpentine; the roscoelite fills fine seams near the face of the walls. A tunnel has been started in the wall and runs 525 ft. along the ledge, and is connected with the surface by an upraise of 225 ft.; a winze is sunk 40 ft. below the level of the tunnel. The two men working here crush the richer specimens in hand mortars. Across the river the same roscoelite-bearing fissures have been found. C. H. Grube and W. B. McKinny, of Lotus, owners.

Sugar Loaf Mine (Quartz).—It is on the western side of Logtown Divide, about 6 miles S. of El Dorado. Years ago a 20-stamp mill was in operation here. The ledge is large, consisting of massive white quartz often crystallized. The gold is not often disseminated through it, but appears in pockets. It has been developed by tunnels and shafts, now caved in. The ledge is on the contact between the diabase forming the divide and the belt of slates so prominent in Big Cañon.

Sunday Mine (Quartz).—It is 1½ miles W. of Grizzly Flat, and is 1,500 by 600 ft., on a N. and S. vein parallel with the Grouse vein, varying from 10 in. to 3 ft. in width, between syenite walls. Developments on the mine consist of a shaft 110 ft. deep, with an 80 ft. drift; the ground to the surface has been stoped. The vein is 22 in. wide and heavily sulphuretted. The shaft is furnished with a horse-whim and Cornish pump. On the hill above the shaft is a 300 ft. tunnel, exposing a vein from 1 to 3 ft. wide. Mrs. M. Jeffrey et al., of Grizzly Flat, owners.

Superior Mine (Quartz).—See our VIIIth and Xth Reports, pp. 187 and 172. W. H. Martin, of Crocker Building, San Francisco, owner.

Taylor Mine (Quartz).—See Idlewild Mine.

Texas Hill Mine (Drift).—This property is 2 miles E. of Placerville, and controls one mile of the channel, which is worked through a tunnel 1,500 ft. long, ending in a 75 ft. incline. The channel is crossed by the tunnel first 100 ft. from the mouth, and again in the end, showing the works to be in a bend in the ancient river. There are two gangways, one to the N. and the other to the N.W. The breasts are carried 100 ft. wide and 4 ft. high; full sets of timber are required, as the roof is in many places sand; no pipe-clay. The bedrock is porphyry. Ventilation is by lower tunnel, but connection will soon be made with an air

shaft now 157 ft. in depth. The gravel is capped by lava 120 ft. thick. Pay gravel, 1 to 3 ft. deep, slightly cemented. The general course of the channel is N.W. About 25 per cent of the mass is cobbles and bowlders. Every "breaster" takes out daily 10 carloads of gravel of 1,600 lbs. weight; cost of recovery of gold per carload is given at 40 cents. The gold is coarse and sells for over $19 per ounce. The 10-stamp mill, with 750 lb. stamps, has a duty of 75 cars per day; the stamps make 95 drops per minute. Steel wire screens with five holes to the inch, and 8 in. of water, are used in the battery. The mill is run by a Knight wheel 5 ft. in diameter, under a 200 ft. head, from El Dorado Water and Deep Gravel Mining Company's ditch. Outside of the mill are 100 ft. of sluices supplied with slat riffles, in three tiers, with 12 ft. drop between them. The apron grooves are cleaned up once a month. Texas Hill Drift Mining Company, lessees; T. Flemming, of Placerville, Superintendent.

Toll House Mining Company's Mine (Drift).—Its property comprises the Hook and Ladder, Henry Clay, and Cowan claims. See our Xth Report, p. 179.

Treat Mine (Quartz).—See our VIIIth Report, p. 178.

Trench Mine (Quartz).—It is in T. 18 N., R. 11 E., in Quartz Cañon, S. of Volcanoville. It forms the southern extension of the Josephine Mine, and is 2,400 by 600 ft. The vein has a northerly course. The surface has been worked quite extensively, but not recently. Heirs of J. Trench, of New York, owners.

True Consolidated Gold Mine (Quartz).—See our VIIIth Report, p. 180. It is situated in Big Cañon, three quarters of a mile N. of Placerville; it comprises 5,400 by 600 ft., consisting of the Halleck, Berry, Old Harmon, and Young Harmon claims. There are two parallel veins having a N.W. trend. The one running between a greenstone hanging- and a slate foot-wall has a width of 4 ft. The other, running through the Old and the Young Harmon, is much larger, averaging 15 ft., and reaching up to 70 ft. in width; it is in black slate, which in places forms excellent roofing slate. True Consolidated Mining Company, owners; John Melton, of Placerville, Superintendent.

Unity Mining Company's Mine (Drift).—Its property is situated in Secs. 3 and 4, T. 10 N., R. 11 E., on Wisconsin Flat, 3 miles N.E. of Placerville, and comprises 178 acres. It is working on the "blue lead" channel, which here has a course S. 60° E. It is capped by lava to a depth of 200 ft.; the lava in places, next to the gravel, showing a decided pink coloring, although there is no distinct line of demarkation between it and the gray lava. The gravel varies in thickness from a few inches to 12 ft., and is cemented, requiring a stamp mill. Where proved, the width of the channel has been found to be 300 ft., with benches of gravel on the sides. Most of the present work is being carried on at the east bench, 13 ft. above the main channel level. The bedrock is syenite. Under the present company none of the channel proper is being worked; under the former owners, 1,700 ft. of the main channel was worked. The present workings are being carried on through an incline shaft 4 by 7 ft., with an arched roof descending at an angle of 30°, furnished with T rails and steam hoist. The shaft is not timbered. The main gangway has 6 ft. posts; the gravel drifts 3 ft. posts; the breasts are timbered with full sets. The breasts are taken 30 ft. wide. The percentage of cobbles and bowlders is small, not over 5 per

cent. Each man extracts daily 5 carloads of gravel, weighing 1,100 lbs. Two shifts of four men each are employed. The gold, which is scaly, is .960 fine. The gravel is crushed in a 10-stamp mill, with 375 lb. stamps, making 90 drops per minute, with 9½ in. drop; discharging through a No. 10 steel wire screen, with a height of discharge of 2 in., and 6 in. of water in the battery. A great deal of the gold is rusty, for which quicksilver traps and Eureka rubbers are used, with 160 ft. of sluices with riffles. The water supply is from El Dorado Water and Deep Gravel Mining Company's ditch. Unity Mining Company, owners; G. W. Kimball, of Placerville, Superintendent.

Valdora Mine (Quartz).—See our VIIIth Report, p. 178.

Vandalia Mine (Quartz).—Abandoned. See our VIIIth Report, p. 172.

Van Hooker Mine (Quartz).—See our VIIIth Report, p. 181.

Vann Mine (Quartz).—This property is situated three quarters of a mile N. of Georgetown, in T. 12 N., R. 10 E. W. D. English and B. Baldwin, of San Francisco, owners.

Webster Claim (Quartz).—It is in T. 13 N., R. 11 E., in Quartz Cañon, S. of Volcanoville, and is 2,000 by 600 ft. The course of the vein is N. 15° E., with dip to the E. of about 55°, showing from 3 in. to 1 ft. of quartz between the contact of serpentine and slate. There are two tunnels on the claim, in the slate, respectively 200 ft. and 300 ft. long, cutting the vein 200 ft. below the surface. From 3 to 4 in. of water issues from the tunnels, which are not timbered. D. C. Webster, of Georgetown, owner.

Welch Gold Mine (Quartz).—It is situated in Bell's Ravine, half a mile N.E. from Greenwood. It is 1,500 by 600 ft., with the vein striking N. 60° W. and dipping N.E. 55°. It is 6 ft. wide, between slate walls. Numerous surface cuts have been made and much of the ground sluiced profitably. An incline has been started in the vein, reaching a depth of 45 ft., but now partially filled with water. Worked by the owner. H. Welch, of Greenwood, owner.

White Bear Mine (Quartz).—See our VIIIth Report, p. 182. Idle.

Wilmantic Mine (Quartz).—It is in the diorite, W. of the "Mother Lode." Shaft said to be 400 ft. deep.

Wilton Gravel Mine (Drift).—Situated 8 miles E. of Georgetown, near Otter Creek. The channel courses southerly, with a width of about 600 ft., and is opened by a bedrock tunnel running up the channel 700 ft., and an upraise of 25 ft. into the gravel; from here gangways are run both E. and W., the bedrock in the former dipping rapidly. The present workings are 60 ft. below the surface. The water supply is derived through the Daggett ditch. Timber is plentiful. W. C. Green, of Georgetown, owner.

Woodside Mine (Quartz).—This property is situated in Georgetown. The vein runs N. and S., in slate, and has yielded a large amount of gold; the works do not extend over 200 ft. in depth. The quartz body is large; prospects over $3 in free gold, and carries some sulphurets. Insufficient machinery to handle the water and lack of capital were the causes of suspension. C. M. Fitzgerald, of Georgetown, owner.

Worthington Mine (Drift).—See XIth Report, p. 206. Idle.

W. W. Claim (Drift).—It is on Cement Hill, 4 miles N. of Georgetown, and is a mere prospect. A tunnel in slate bedrock is being run by two men to tap a channel supposed to cross the line of the tunnel in

a S.E. course. At present the tunnel is in 400 ft. No timbering required. The claim is 1,500 by 600 ft. R. S. Wilton, of Georgetown, owner.

Zentgraf's Gold Mine (Quartz).—This property was described in our VIIIth Report, p. 200, and is situated close to the North Fork of the American River, on Wild Goose Flat, 8 miles S. from Newcastle, in T. 11 N., R. 11 E. The vein strikes N.W. and dips S.E. at an angle of 40°, between granite and slate walls. J. & G. Zentgraf, of Newcastle, owners.

FRESNO COUNTY.

Not only does Fresno County possess a well-earned reputation for productive orchards and vineyards and fertile lands, but her mountains contain numerous mineral deposits. Some of these are at present lightly esteemed, as they are situated in places difficult of access, but as facilities of transportation are extended and advances are made in manufacture and art, there is no doubt but that the minerals of Fresno will prove of great value. The mining interests are situated both in the Sierra and in the Coast Range.

In the Sierra there are veins which yield gold, silver, copper, lead, and bismuth; and there is a deposit of iron ore which is said to be one of the largest and most valuable in the world. The Sierra is timbered almost from the foothills to the snow line, and nearly every cañon has a flowing stream.

In the Coast Range, on the western side of the county, there are deposits of coal, better in quality and equal in quantity to any found in the State, and there are formations which yield petroleum and gypsum.

The principal mines in that portion of the Sierra which is included within the boundaries of Fresno County are situated in the Temperance Flat, Sycamore, and Big Dry Creek mining districts; there are some also in the vicinity of Sampson's Flat. Extensive ledges of silver- and copper-bearing ores are found high up near the snow line of the Sierra. The country rock in the mining districts of the foothill region is for the most part granitic, passing into gneissoid rocks and mica slate.

Barnes Mine (Quartz).—It is in Sycamore District. There are two tunnels, one 300 and the other 800 ft. in length; the vein varies from 12 to 18 in. in thickness. The milling plant consists of a 3½ ft. Huntington mill and a McGlew concentrator. G. W. Barnes, of Toll House, owner.

Big Sampson Mine (Quartz).—It is about 1 mile W. of Sampson's Flat. In the 50 ft. shaft and old workings it is said the vein shows a width of from 3 to 14 ft. between walls. See our VIIIth Report, p. 207. It was idle in June, 1894. The milling plant consists of a Kendall rocker mill, with a capacity of 8 tons in twenty-four hours. Heirs of B. H. Sterns, deceased, of Visalia, Tulare County, owners.

Black Jack Mine (Quartz).—This is a southerly extension of the Big Sampson. The developments consist of a 90 ft. shaft. A. Hammersly, of Bakersfield, Kern County, owner.

Blue Rock (*Midnight Star*) *Mine* (Quartz).—It is in Big Creek Mining District, and is a southerly extension of the Champion. The developments consist of an open cut and several small shafts on a ledge 4 to 10 ft. wide. Mrs. M. Jensen, of Letcher, owner.

Boyd & Slater Claim (Placer).—It is on Mill Creek, about 5 miles N.E. of Dunlap. In June, 1894, 6 men were engaged in sluicing on this claim. Boyd & Slater, of Dunlap, owners.

Champion Mine (Quartz).—This claim, on patented land in Big Dry Creek Mining District, is a southerly extension of the Defiance. Developments consist of a tunnel and shaft, partly caved. F. Gross, of Letcher, owner.

Chipmunk Mine (Quartz).—See Fisk Mines.

Confidence Mine (Quartz).—This claim is in Big Dry Creek Mining District, and is a southerly extension of the Blue Rock. Developments consist of two 60 ft. shafts, a 500 ft. tunnel, and several old workings. The ledge has a width of from 1 to 4 ft., and shows some sulphurets. See our VIIIth and Xth Reports, pp. 208 and 193. E. Loyd, of Letcher, owner.

Crystal Springs Mine (Quartz).—It is in Big Dry Creek Mining District, and is a northwesterly extension of the Defiance. The developments consist of a 50 ft. tunnel, and the quartz shows sulphurets and free gold. Jo Vernette, of Letcher, owner.

Defiance Mine (Quartz).—This claim is in Big Dry Creek Mining District. Developments consist of a 260 ft. tunnel and a 40 ft. shaft. The ledge varies in width from 8 in. to 5 ft. It dips about 80° N.E. and carries some sulphurets. F. Gross, of Letcher, owner.

Discovery Claim (Placer).—It is on Mill Creek, about 3 miles W. of Dunlap P. O. J. L. Gregg et al., of Dunlap, owners.

Emma (Yorton) Mine (Quartz).—This claim, situated in Big Dry Creek Mining District, is a southerly extension of the Mt. Sterling. The developments appear to be made on an extension of the second vein, about 1 ft. wide, mentioned in the description of the Mt. Sterling. The wall rock appears to be a gneiss, in which mica predominates. Hugh Nipper et al., of Letcher, owners.

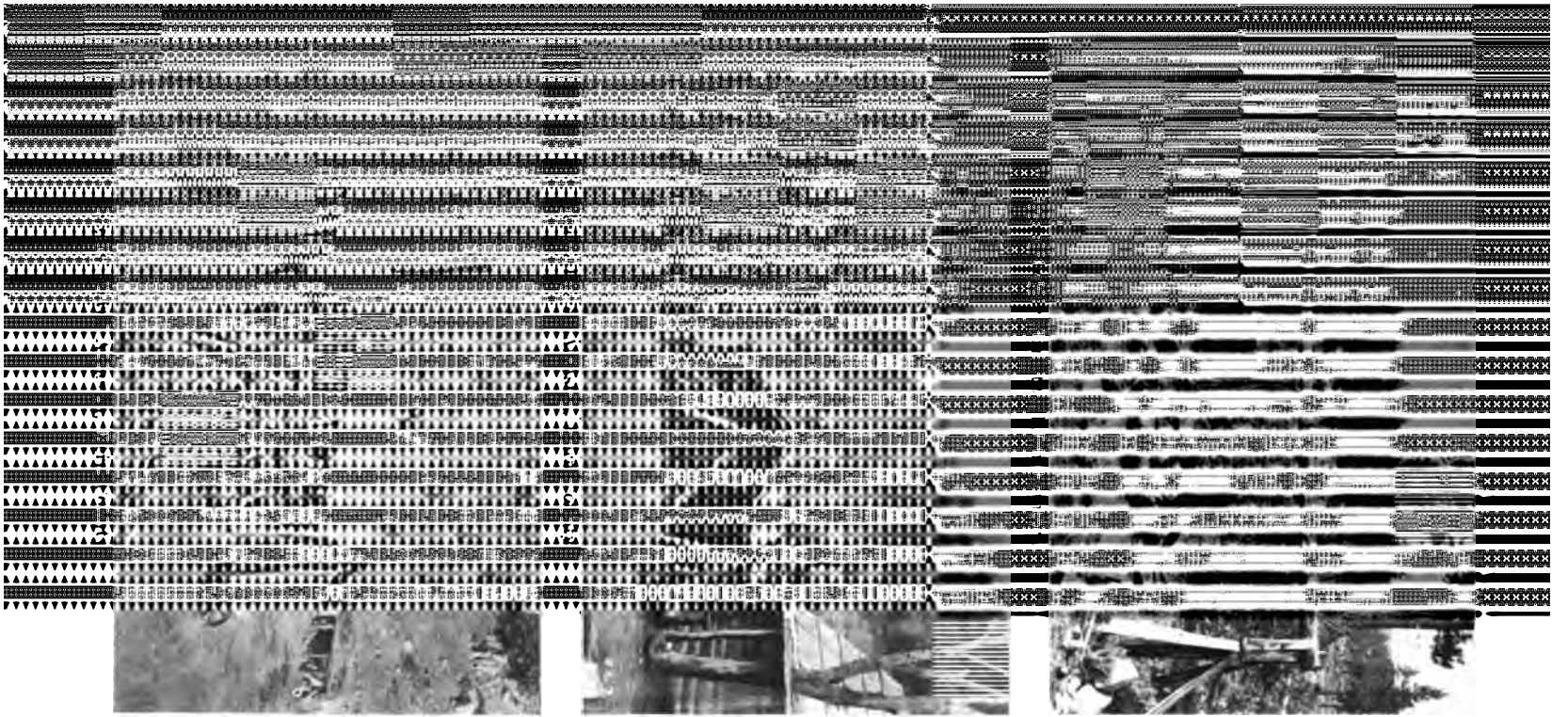
Fisk Mines (Quartz).—These comprise the *Luakala*, *Phantom*, *Yankee*, *Chipmunk*, and *Tamarac* claims. They are at the junction of Triple Falls Creek and the Middle Fork of Kings River, and are about 4 miles N.E. of the Big Meadows on the Middle Fork of Kings River. The principal developments are on the Luakala Mine, where there is a 50 ft. shaft and a 50 ft. tunnel. The ledge is said to be 21 ft. in thickness, with a pay streak of about 2 ft., and carries sulphides of iron and silver. On the Chipmunk and the Tamarac; the ledge is said to be 30 ft. wide, with a pay streak of about 4 ft.

Gilkie Mine (Placer).—It is situated at Sampson's Flat. S. C. Moore, of Dunlap, owner.

Grub Stake Mine (Quartz).—This claim, in Big Dry Creek Mining District, is a northwestern extension of the Mt. Sterling. The vein is 4 to 15 in. wide. Hugh Nipper et al., of Letcher, owners.

Hercules Mine (Quartz).—This is situated at Sampson's Flat. The claim is opened by a 150 ft. tunnel, and the vein shows a width of from 6 in. to 3 ft. S. C. Moore, of Dunlap, owner.

Herron Mine (Quartz).—This mine is in Auberry Valley. The principal developments consist of an 800 ft. tunnel, with several stopes and one 30 ft. winze. There are also several old workings. The ledge varies in thickness from a few inches to 6 ft., its average width being about 3 ft., and the pay streak varies from a few inches to about 2 ft. The vein matter consists of clayey material and clean quartz showing sulphurets. The ledge dips 45° to 60° N.W. in granite. Adjoining the mine is a 5 ft. Huntington mill and two concentrators. See also our XIth Report, p. 215. Shepperd Bros. and J. C. Hosie, of Fresno, owners.



Hancock Mine (Quartz).—This is a southeasterly extension of the Slocum. It is on Big Dry Creek, a tributary of Kings River, and in Sycamore District. There are four tunnels, varying from 50 to 200 ft. A rocker mill with a capacity of 5 tons in twenty-four hours is part of the plant. B. Hancock, of Letcher, owner.

Hidden Treasure Mine (Quartz).—This claim is near Temperance Flat. In the small shaft the ledge is about 4 ft. wide, with a pay streak of about 1 ft. W. B. Brecken and Dr. J. Graham, of Fresno, owners.

Homestake Mine (Placer).—On this mine, situated on Sampson's Flat Creek, work is usually prosecuted during the winter. It is said that the stratum of auriferous gravel, about 4 ft. thick, covers an area of about 10 acres. J. N. Albin et al., of Fresno, owners.

Inyo Mine (Quartz).—It is situated at Temperance Flat. Developments consist of four tunnels, which are respectively 400, 150, 135, and 105 ft. in length, with several stopes and old workings. The vein varies in width from a few inches to about 4 ft., showing an average width of about 2 ft. of pay ore. The vein dips about 30° N.W. The country rock is granitic. A No. 1 Kendall mill, run by steam power, is connected with the property. J. S. Johnson and N. Sullivan, of Auberry, owners.

John Burnett Mine (Quartz).—This claim is on patented land, and in Sec. 20, T. 11 N., R. 23 E. There is a 30 ft. shaft; and the vein, showing free gold, varies in width from 1 to 6 in., and stands nearly vertical. J. McDonell, of Sentinel, owner.

Keno Mine (Quartz).—In this claim at Temperance Flat, developments consist of a 240 ft. tunnel, from which two levels have been run, about 300 and 110 ft., respectively; also a 136 ft. incline. The principal vein shows a width varying from 6 in. to several feet, and dips about 60° S.W. The ledge consists of clayey matter containing fragments of quartz. There are also two or three smaller veins in the mine. At this mine there is a 10-stamp mill. Fresno Milling and Mining Company, of Fresno, owners.

Lemmon's Mine (Placer).—This is on Stevenson Creek, about 3 miles E. of the San Joaquin River. D. M. Lemmon, of North Fork, Madera County, owner.

Little Monitor Mine (Quartz).—It is in Davis Flat. A. P. Davis and S. C. Moore, of Dunlap, owners.

Luakala Mine (Quartz).—See Fisk Mines.

Lucky Joe Mine (Quartz).—This claim, in Big Dry Creek Mining District, is a northwesterly extension of the Crystal Springs. The developments consist of open cuts, and the ledge varies from about 2 in. to 1 ft. Charles Bayard, of Letcher, owner.

McDonald Mine (Quartz).—This is a northwesterly extension of the Barnes, and is in Sycamore District. In the 20 ft. tunnel the vein shows a width of from 12 to 18 in. J. W. McDonald, of Fresno, owner.

Mersaba Mine (Placer).—See Ohio Mine.

Midnight Star Mine (Quartz).—See Blue Rock.

Minnette Mine (Quartz).—This is on Upper Big Creek, in Sycamore District. In the 50 ft. tunnel the vein is said to show a thickness of about 18 in., dips about 45° N.E., and shows sulphurets and free gold; it is worked in an arrastra driven by water power. E. Minnette, of Fresno, owner.

Morrow Mine (Quartz).—See Petrea.

Mount Stirling Mine (Quartz).—This mine is situated between Fancher and Dog Creek. Developments consist of four 30 ft. shafts and one 160 ft. shaft. The vein on which the principal workings are situated shows a width of from 6 in. to about 2 ft., and dips 80° N.E. The ore is sugar-grained quartz, showing free gold and a few sulphurets. On this claim there is a second vein, about 1 ft. wide, running nearly parallel to the other at a distance of about 150 ft. The ore has a coarser structure and is said to be of lower grade. M. V. Ashbrook, of Letcher, owner.

Music Mine (Quartz).—See Providence.

Ninety-nine Mine (Quartz).—This claim is in Sec. 10, T. 14 S., R. 26 E. It is said that the developments consist of a 175 ft. and a 75 ft. tunnel, and a 100 ft. and a 20 ft. shaft; also that the vein varies in width from 1 to 3 ft. L. W. Howell, of Dunlap, owner.

Ohio and Mersaba Mines (Placer).—They are situated on the San Joaquin River at the mouth of Fine Gold Gulch, and about 5 miles up the river from Pollasky. It is proposed to turn the water from a bend of the San Joaquin and work its channel. Ohio Gold Mining Company, of Fresno, owners.

Oro Fino, Nos. 1 and 2, Mines (Quartz).—These claims are at Davis Flat, about 2 miles N. from Sampson's Flat. There is a small shaft and short tunnel and also a large open cut, which has been formed by ground-sluicing. See our VIIIth Report, pp. 207 and 208. A. P. Davis, of Traver, owner.

Petrea (Morrow) Mine (Quartz).—It is on Little Dry Creek, in Sec. 7, T. 11 S., R. 23 E. A. W. Petrea, of Fresno, owner.

Phantom Mine (Quartz).—See Fisk Mines.

Protection Mine (Quartz).—In this claim at Temperance Flat, developments consist of a 50 ft. shaft and open cuts. The veins show a width of between 3 and 4 ft., and dip about 40° N.W. J. Hosie and W. A. Shepperd, of Fresno, owners.

Providence (Music) Mine (Quartz).—This claim is on Pine Ridge, in Sycamore Mining District. It is said that the developments consist of a 200 ft. shaft, two 500 ft. levels, and two that are about 300 ft. in length. The ore is worked in a Dodge pulverizer. See our VIIIth Report, p. 206. — Howard, of Toll House, owner.

Quien Sabe Mine (Quartz).—This mine is about 1½ miles N.W. of Temperance Flat. Developments consist of a small shaft and a 600 ft. tunnel. D. H. Jackson, of Auberry, owner.

Rattlesnake Mine (Quartz).—This claim, which is patented, is about 1 mile W. of Temperance Flat. Developments consist of several tunnels and shafts, which in May, 1894, were partly filled with water. See our VIIIth Report, p. 215. D. H. Jackson, of Oakland, Alameda County, owner.

Sampson Mine (Quartz).—See Big Sampson Mine.

Sawyer & Murray Claim (Placer).—Situated on Mill Creek, about 5 miles N.E. of Dunlap. In June, 1894, four men were sluicing. Sawyer & Murray, of Dunlap, owners.

Slocum Mine (Quartz).—This is a southeasterly extension of the Barnes, and is in Sycamore District. The developments consist of a 30 ft., a 50 ft., and a 100 ft. tunnel. — Slocum, of Reedley, owner.

Smuggle Mine (Quartz).—This mine is at Temperance Flat. Developments consist of a 25 and a 40 ft. tunnel. The vein shows a width of

about 5 in. and dips about 60° N.W. The walls are granitic; ore shows sulphurets. R. Welch and H. T. Harrison, of Auberry, owners.

Speedy Mine (Quartz).—This claim, at Temperance Flat, is a southwesterly extension of the Wide-Awake. Developments consist of a 10 ft. shaft and open cuts. The vein shows a width of about 2 ft. The walls are granitic. H. Rauscher, of Auberry, owner.

Tamarac Mine (Quartz).—See Fisk Mines.

Temperance Mine (Quartz).—See Wide-Awake Mine.

Thornton Mine (Drift).—This claim is 4 miles S.W. of Temperance Flat, on the east bank of the San Joaquin. Developments consist of more than 100 ft. of tunnels and drifts. During the winter, water for sluicing is obtained from creeks and gulches, and in summer it is pumped from the San Joaquin River. Four men are employed. See our XIth Report, p. 215. O. B. Olfs et al., of Fresno, owners.

Thorn Mine (Quartz).—It is in Big Dry Creek Mining District. Developments consist of a 120 and a 60 ft. tunnel, with stopes. The vein is said to have a width of from 6 to 18 in. T. Waxford, of Sentinel, owner.

Valley View Mine (Quartz).—This claim is in Sec. 32, T. 11 S., R. 22 E. Developments consist of a 40 ft. shaft and a 140 ft. tunnel. The vein varies from a few inches to about one foot. It stands nearly vertical and has a strike of S.E. and N.W. The sugar-grained quartz shows free gold. Chris. Petersen, of Sentinel, owner.

Victoria Mine (Quartz).—It is at Temperance Flat. Developments consist of two 30 ft. tunnels; the vein shows an average width of about 14 in. J. R. Whittaker et al., of Auberry, owners.

Wakefield Mine (Placer).—This is in Dinkley Creek, a tributary of Laurel Creek, and in Sycamore Mining District. W. Wakefield, of Toll House, owner.

Weatherby Mine (Quartz).—It is in Auberry Valley. Developments consist of a 100 ft. incline, with stopes, and a 140 ft. incline, from which two drifts have been run upon the vein for a distance of 100 ft. and 60 ft., respectively. The width of the vein varies from 12 to 14 in., and dips 30° N.W. Logan Baird et al., of Garfield, owners.

White Cross Mine (Quartz).—It is in Sec. 10, T. 14 S., R. 26 E. Developments are said to consist of a 100 ft. tunnel and a 30 ft. shaft. See our VIIIth Report, p. 208. T. L. Reed et al., of Reedley, owners.

Wide-Awake (*Temperance*) *Mine* (Quartz).—In this mine, at Temperance Flat, developments consist of a 100 ft. tunnel, three 40 ft. stopes, and several workings. The vein varies in width from a few inches to about 2 ft., and dips about 30° N.W. The ore shows sulphurets, and the walls are granitic. W. Dolph and J. Golden, of Auberry, owners.

Yankee Mine (Quartz).—See Fisk Mines.

Yorton Mine (Quartz).—See Emma Mine.

GLENN COUNTY.

This county occupies a central position among the counties of the Sacramento Valley. The eastern and central portions of the county possess some of the finest wheat-growing lands in the State. Farther westward are foothills and valleys, where good crops are the rule. Orchards thrive without irrigation. There is a good range for stock at all seasons of the year.

In the mountains on the western border of the county, there are

extensive deposits of chromic iron, and "prospects" of cinnabar and gold-bearing ore are reported. There are also several valuable mineral springs.

The Milsap Mine (Quartz).—This mine is situated between Grindstone Creek and Milsap Creek. In August, 1894, two men were employed in prospecting the ledge, which is almost 4 ft. in width.

HUMBOLDT COUNTY.

Big Bar Mine (Hydraulic).—This claim was filled by high water in 1890 and the ditches destroyed. No attempt has since been made to reopen the mine, although there are several acres of rich gravel left.

Big Lagoon, Gold Sand at.—See our XIth Report, p. 230.

Bistel Mine (Hydraulic).—It lies along Trinity River, 1 mile below Brown Station, at the mouth of Willow Creek. About 500 in. of water is derived from Willow Creek, through 2 miles of ditch and 1,000 ft. of 12 in. pipe to a giant with 3½ and 4 in. nozzles. The bedrock is soft blue slate and lies 10 to 25 ft. above the river. The banks are 25 ft. high, and average 8 ft. of pay gravel. The claim is on an old channel, which runs parallel to the channel of Trinity River for nearly 2 miles, the whole of which is said to be rich in coarse gold. The claim has been idle for some time, on account of the dam and upper part of the ditch being washed out by the floods in Willow Creek.

Croton Bar Mine (Hydraulic).—It is on the Klamath River, 1½ miles above Orleans. It comprises 20 acres and has 2,000 ft. frontage on the river. The bedrock is micaceous slate and lies some 40 ft. above low water in the river. The bank is 50 ft. high and the gravel 30 ft. deep. About 500 inches of water is taken out of Wilson Creek by a ditch and flume, 18 by 14 in., 2 miles long, on a grade of 2½ in. per 12 ft. Half a mile of pipe is in use, 24 in., 18 in., 15 in., and 11 in. in diameter; also two giants, with 3½ and 4 in. nozzles, under 150 ft. pressure. The sluices, 2 by 20 in., are 400 ft. long and have a grade of 9 in. per box. The water season is about six months; and about 1 acre was cleaned up last winter. E. Markerson, of Orleans, owner.

Ferris Claim (Placer).—This is on the Klamath River, about 1 mile below Orleans. It contains 30 acres of ground and has 500 ft. frontage on the river. One mile of ditch collects water from a number of small gulches, and delivers about 100 in. for three months in the year. There are 600 ft. of 9 in. pipe and a giant with 4 in. nozzle under a 60 ft. head, and 200 ft. of sluices, 18 by 18 in., with block riffles. A. Ferris, of Orleans, owner.

Mr. Ferris is doing some sluicing on a bar in the Klamath River at present (September, 1894). A wooden dump car running on a wooden track is used to run the gravel to the main channel, where, by an ingenious arrangement of cheap wingdams, sufficient water is diverted to fill the sluices and keep them clear. There are 60 ft. of 12 by 12 in. sluices, and about 15 cu. yds. of material are washed per day. The gravel deposit on bedrock is about 3 ft. deep, and is said to be renewed every year by deposition of gold and gravel during high water.

Graham Flat Mine (Hydraulic).—See Orleans Bar.

Hoopa Valley.—It is the general belief that the bars along the river throughout the Reservation are very rich, but as the Indians object to having them worked, nothing is done.

Johnson Ranch, Gold Washing at the.—See our XIth Report, p. 332.

Klamath River.—The hydraulic mines along the river in Humboldt County derive their water from the tributaries, and can only be worked successfully during the rainy season and in the spring.

Lower Gold Bluffs, Beach Washing at.—Is still carried on in a small way. See our XIth Report, p. 232.

Manapier Mine (Placer).—It is half a mile below Klamath Bluff. One quarter of a mile of ditch brings about 150 in. of water from Blocksser Creek, and 80 ft. of 6 in. pipe and a hose with a 2 in. nozzle are used. F. Sebastian, of Klamath Bluff, owner.

Maston Claim (Placer).—It lies at the mouth of the North Fork of Trinity River, and comprises about 300 acres of gravel, said to be very rich. A ditch 8 miles long and nearly completed will furnish 1,000 in. of water under a 200 ft. head. J. J. Maston, Superintendent.

Mettah Mine (Placer).—It is about 4 miles above Klamath Bluff. The gravel is on a low bar in the river and on the bank, and is worked in rockers. The claim is covered during flood stages of the river, and can be worked only during the summer.

Morris' Claim (Placer).—This is on Willow Creek, S. of the Hoopa Reservation. The gravel in the bottom of the creek is from a few inches to 8 ft. deep. Wingdams are used to divert the water and expose the bed of the creek. The gold is coarse and angular, and is often attached to pieces of quartz, which may indicate that it has not traveled for any great distance.

Orleans Bar Placer Mining Company's Mine (Hydraulic).—They own about 2,500 acres, partly patented, in and around the town of Orleans. They built a ditch 11 miles long, to bring the water of Camp Creek, which is quite a large stream, but in January, 1890, an unprecedentedly heavy fall of snow, followed by a warm rain, washed out a great part of it and it has not been repaired.

The upper workings were formerly known as the *Wilder Claim*, and as it is supplied by an independent ditch from Little Wilder Creek and Sim's Gulch, work is carried on there every winter. The claim contains 1,000 acres of patented land immediately above the town. The ditch is 6 miles long and furnishes 300 in. of water under a 125 ft. pressure, eight months in the year. They use 600 ft. of 18 in. and 15 in. pipe, two "giants" with 4 in. nozzles, and 900 ft. of 26 in. sluices, on a 6 in. grade, with block riffles. The gold, generally of the size of a pin head, is mostly caught with the first 150 ft. of the sluices, and this part is cleaned up every ten days. The bedrock is a soft micaceous slate, containing seams of quartz and iron sulphurets. The bank is 30 ft. high and shows about 8 ft. of pay gravel.

The lower works are about 1 mile below the town, and were formerly known as the *Graham Flat Claim.* The bar embraces 28 acres of gravel, 30 to 50 ft. deep. About 2 acres were cleaned up here before the Camp Creek ditch broke, and it is said yielded satisfactorily. The sluices are 42 in. wide and 30 in. deep. The water is delivered through 800 ft. of pipe under a 350 ft. head. The bedrock lies 30 ft. above the river, so that tailings are easily disposed of. Freight per pack train from end of railroad at Korbel to Orleans is 3 cents per pound, and it takes ten to twelve days for the round trip. Owned in London, England; Mr. P. L. Young, of Crescent City, Superintendent.

Pearch Mine (Hydraulic).—It is on the Klamath, 1 mile above and opposite Orleans. It contains 80 acres and has about half a mile frontage on the river. A ditch 1 mile long from Pearch or Mill Creek furnishes about 900 inches of water. There are 700 ft. of 22 in. and 15 in. pipe, delivering the water under a 125 ft. pressure to two "giants," with 4 in. and 6 in. nozzles. There are two sluices 300 and 700 ft. long, 30 in. wide, with 6 in. grade. The banks are 50 ft. high and nearly all gravel. A sawmill on the claim furnishes the lumber; the 56 in. saw is driven by a 3½ ft. hurdy wheel, by water taken from the main pipe under pressure of about 100 ft. J. A. Pearch, of Orleans, owner.

Red Cap Mine (Hydraulic).—It is on the right bank of Klamath River, opposite the mouth of Red Cap Creek. Water is derived from Little Red Cap Creek by a ditch 1¼ miles long, using flumes 16 by 15 in. on a grade of 1½ in. in 12 ft.; 500 ft. of 11 and 7 in. pipe delivers the water, under a 150 ft. head, to a "giant" with 3 in. nozzle. A small reservoir is used to collect water enough to run three hours per day during the dry season. There are 600 ft. of sluices, 24 by 20 in., with block riffles and on a 7 in. grade per box. There remains about 10 acres of gravel unworked. Wm. Lord, of Orleans, owner.

Redwood Creek, Beach Washing at the Mouth of.—See our XIth Report. p. 232.

Salstrom's Mine (Placer).—This is 1½ miles below Orleans, on the Klamath River and Camp Creek. The claim contains 80 acres, partly on a low shelf, which is submerged during flood stages of the river, and partly on the second shelf, where the bedrock lies 30 ft. above high water. A flume 36 by 16 in., one third of a mile long, delivers 800 in. of water from Salstrom Creek through 650 ft. of 14 in. and 10 in. pipe to a "giant" with a 3 in. nozzle, under 130 ft. head. The bank varies from 25 to 50 ft. in height, and the pay gravel from 10 to 30 ft. There are 400 ft. of sluices. As stated above, the lower shelf is covered with water when the river is high, and in the summer when the bar could be worked there is no water in Salstrom Creek. It is therefore necessary to build a ditch 3 miles long to bring water from Camp Creek, which has sufficient during the summer to permit work in a small way. Jonas Salstrom, of Orleans, owner.

Trinity River.—All along the river prospectors are at work washing with rockers or sluices either in the bed or on the banks of the river. They are said to earn not less than a dollar per day.

Two-Yoke Bar Mine (Hydraulic).—This is on the Klamath River, 2 miles below Orleans. During high water in 1890 the claim was filled and the ditches destroyed. No work has been done since.

Upper Gold Bluffs.—They are situated on the seashore, and extend south from Osagon Creek about 5 miles. The bluffs from which the property is named rise to the height of from 200 to 300 ft., and are composed for the most part of friable sandstone and conglomerate, the latter predominating. At the base of the bluffs the dip is about 15° N.E. In the upper portions of the bluffs the conglomerate is interstratified with well-defined strata of yellowish sand and light-colored sediment, which are practically horizontal. The only fossils are a few lignitized plant remains. The conglomerate is said to be auriferous and to supply the gold which is found on the seashore at the Gold Bluffs. This conglomerate extends inland, and several years ago hydraulic mining was carried on, and 1,000 ft. of tunnel was run to divert water from Prairie

Creek. It is said that in 1879 the Upper Gold Bluffs property was surveyed so that the surface of the conglomerate or gravel was divided by survey lines which formed 180 intersections, which were equal distances apart; that prospect shafts were sunk at each intersection, and that auriferous gravel was found in every shaft. (A few panfuls of gravel from one of these shafts yielded several colors of rather coarse gold.) The present owner states that experimental washings, in several places, have shown as high as 20 cents in gold to the cubic yard. Edson Adams, of Oakland, Alameda County, owner.

Uscellena Mine (Hydraulic).—It is on the Klamath River, 7 miles above Orleans. The bank is 60 ft. high, and shows 15 ft. of pay gravel. A ditch 3 miles long collects 300 to 400 in. of water from Mud Creek and several smaller streams. There are 500 ft. of 14 in. and 11 in. pipe; a giant with a 3 in. nozzle, under a 160 ft. pressure; and 350 ft. of 24 in. sluices, with block riffles. The ditches of this claim were injured to some extent during the high water of 1890 and have not been restored completely, so that the mine is worked only in a small way. L. Nelson, of Orleans, owner.

White's Claim (Placer).—See Morris' Claim, which it adjoins.

Weitchpec Mine (Hydraulic).—It is at the lower end of the village of the same name, opposite the mouth of Trinity River. It contains 25 acres of gravel. Water is derived from a number of small reservoirs in Weitchpec Creek and carried through a ditch half a mile long with flumes 32 in. wide, on a grade of $\frac{3}{4}$ in. to 12 ft. The water is delivered through 500 ft. of 11 in. pipe to a giant with 4 in. nozzle, under 125 ft. pressure. The sluices are 400 ft. long and 24 in. wide. The bedrock is a very soft talcose slate, and is about 30 ft. above the river. The bank is 30 ft. high and shows 10 ft. of gravel. Many large bowlders are found and a large derrick is used to pile them to one side. The hoisting is done with a small wooden hurdy wheel, taking its water from the pipe immediately above the giant. This is the only mine on the Klamath River in Humboldt County which has water enough to run all summer. Wm. Lord, of Orleans, owner.

Wilder Claim (Hydraulic).—See Orleans Bar.

Young's Mine (Hydraulic).—This is on the Klamath River, 10 miles above Klamath Bluff. Water is obtained from a number of small creeks by short ditches. There are 250 ft. of 11 in. pipe and a small giant under 100 ft. pressure. The bedrock is about 300 ft. above the river, and consists of a soft blue slate. The claim is nearly worked out, only a small patch of gravel remaining. Mr. Young, of Weitchpec, owner.

INYO COUNTY.

Inyo County is not a very large producer of gold, its output of that metal being less than its silver product. There are, however, several small gold camps from which there was a total output, in 1893, of $25,944, an increase over the previous year's record.

Abe Lincoln Mine (Quartz).—See Lonella Mine.

American Flag Mine (Quartz).—It is on the ridge between Craig's and Allen's cañons, on the eastern slope of the Inyo range. The elevation is about 7,000 ft. The ledge varies from 1 to 4 ft. in width, inclosed in granite, and is developed by a tunnel 45 ft. long. The greater portion of the vein carries a little gold, but there are in places very rich pockets

of galena associated with coarse gold. The gold is sometimes found inclosed in the galena. Victor Trapier, of Lone Pine, owner.

Argus Cañon Gold Mines (Quartz).—Near the mouth of Argus Cañon, on the western slope of the Argus range, are fifteen claims. The ledges are characterized by the excess of the gold contents over the silver, but in general appearance resemble the others in this part of Inyo County. They lie on both sides of Argus Cañon, the southerly ones being quite flat, while the northerly ones are steeply inclined. The greatest development is on the South Inyo claim, on the north side of the cañon. A tunnel has been run on the ledge 120 ft., showing a thickness of 1 to 4 ft. The quartz is hard but honeycombed. One half mile north, on another claim, a tunnel has been run 80 ft. South of Argus Cañon is a large vein, on which five locations have been made. W. C. Wilson, of Mojave, Kern County, owner.

Baranca Mine (Quartz).—This mine is situated on the ridge south of Craig's Cañon, on the eastern slope of the Inyo range; the altitude is 7,000 ft. A number of veins occur on this claim, all of which have been more or less worked. The greatest development is a 250 ft. tunnel. Adjoining this mine are two other claims, on which some work has been done.

Bonanza Mine (Quartz).—This mine is 25 miles S. of Darwin, in Mountain Spring Cañon. The ledge is inclosed in granite, and is quite irregular, varying from mere stringers to 2 ft. in width. A depth of 200 ft. has been reached on the incline, with drifts N. and S. Three other veins run parallel with the main one. The ore is milled in an arrastra. John Andrada, of Freeman P. O., owner.

Briton & Porter Mine (Quartz).—It is situated on the north side of Robles Cañon, at an altitude of 6,600 ft. Although this is one of the oldest mines in the district, it has laid idle until recently. Work is now in progress upon a large vein of sugary quartz. The old incline, which followed the vein in, is 170 ft. long, and will be extended several hundred feet, if the indications are favorable. The vein is 2 to 7 ft. wide, and strikes E. and W., and dips 20° to 25° N. into a granitic spur of the Inyo range.

Farther west on the same vein, and owned by the same parties, is the *Bronco Mine*, where a shaft has been sunk to a depth of 110 ft. The dip is 70°. The quartz carries free gold, and a little silver in galena, copper and iron sulphurets. The vein as a whole is one of the largest and most regular in the district. If the developments are favorable it is the intention to erect a 10-stamp mill at the junction of Robles and Hunter's cañons, where there is nearly 20 in. of water. The ore can be sent to the mill on a tramway. J. J. Haley, of San Francisco, owner; W. L. Hunter, of Independence, Superintendent.

Brown Monster (*Eclipse*) *Mine* (Quartz).—It is near the western base of the Inyo range, and S.E. of Independence. The vein lies in limestone, dips into the range at an angle of 15° to 20°, and averages 5 ft. wide. An incline for a double track has been sunk on the vein to a distance of 400 ft. Although this is essentially a gold mine, there is frequently found a thin layer of silver-bearing galena on the hanging-wall. The most of the gold is found in iron streaks running through the quartz. In the stopes to the left of the incline the vein was found to be 12 ft. thick; in the bottom of the incline it is said to be 5 ft. thick, dipping 25°. The ore was transported by a tramway to the river, where a

20-stamp mill was operated for many years. See our VIIIth Report, p. 263. A. W. Eibeshutz, of Independence, owner.

Chilula, Gavilan, Montano, and San Antonio Mines (Quartz).—This group is situated near the head of Robles Cañon, on the eastern part of the Inyo range.

The Chilula lies partly in limestone and partly in granite. The limestone is found on the western end of the claim, and it is here that silver ore is found. On the eastern end of the claim a tunnel has been run 400 ft. in granite. A rich shoot of ore was followed down from the surface to this tunnel. As the ledge passes from the granite to the limestone, the most of the gold content disappears and silver-bearing galena takes its place.

The Gavilan is one of the few vertical veins in the district. It lies on the south side of the cañon, which is quite precipitous at this point. The ledge was finely exposed vertically for a distance of 100 ft., and it was only necessary to blast it from the wall of the cañon. It averages 5 ft. in width, and has been worked at least 200 ft. in depth. The strike is E. and W., and the inclosing formation granite.

The Montano is a bunchy vein near by, which has been opened to about 50 ft. in depth. North of the cañon is another of this group of mines, where a vein has been opened by inclines and considerable stoping done. It is 5 ft. wide in places and dips N., and is quite similar to and lies a little above the Bronco Mine. Wilson & Montano, of Lone Pine, owners.

Garfield Mine (Quartz).—This mine is one of the oldest in the Fish Springs District. A large amount of work has been done on a small ledge, which tips W. at a small angle. The quartz is bunchy and pockety in character. This property was abandoned at one time, but has recently been relocated, and is now being worked. Jerry Moiers, of Independence, owner.

Georgia Mine (Quartz).—It is on the western slope of the White Mountains, 10 miles E. of Bishop Creek. In the granitic country rock are two sets of veins; the flat ones often contain gold-bearing quartz, while the other set, which are more nearly vertical, is barren. The flat ledges run N.W. and S.E. The vein on which the Georgia Mine is situated has a width varying from a mere seam up to 20 in. The ore is high grade, the gold being mostly free. There is a small amount of iron and copper sulphurets. This mine is developed by 260 ft. of tunnels and 75 ft. of winzes.

Gold Bug Mine (Quartz).—It is on Fish Springs Hill, 20 miles N. of Independence. The vein is small, and runs E. and W. on the contact of granite with a dark, fine-grained dike. A large amount of work has been done on this mine. There are three tunnels; the upper is 115, the middle 600, and the lower 200 ft. long. The sulphurets are abundant and rich, and the gold fine.

Gold Gulch Mine (Quartz).—This is a recent discovery, situated in Gold Gulch, on the western slope of the Panamint range. Here four claims have been located on a vein running N.E. and S.W., and dipping 45°; the hanging-wall being limestone. The vein is said to be 18 in. wide and traceable for a thousand feet. Messrs. R. W. McIntyre, M. F. Clute, Geo. Calwell, and O. W. Shafer, of Redlands, owners.

Golden Reef Mine (Quartz).—It is in the Fish Springs District, 18 miles N. of Independence. The vein is inclosed in a granitic rock, and

strikes nearly N. and S. and dips about 45° E. It varies in width from a mere stringer to 20 in., and consists of iron and copper sulphurets, brown iron, and free gold. The free gold is obtained by crushing in an arrastra, and the tailings, which are rich, are saved for future treatment. J. McSorty, of Big Pine, owner.

Hirsh Mine (Quartz).—It is situated on the western slope of the Inyo range and a little above the Brown Monster. It is developed by a tunnel 100 ft. long and a drift south on the ledge 200 ft. From the drift three winzes were sunk. The vein is 4 to 8 ft. wide, and consists partly of gold-bearing quartz and partly of galena carrying silver. The galena occurs on the foot-wall, and at one spot was found to be 3 ft. in width. The ledge strikes N. and S. and dips 30° E. The most of the work in this mine has been done during the last three years, although it was opened many years ago. Nathan Rhine, of Independence, owner.

Hope Mine (Quartz).—It is situated near the base of the Inyo range, 15 miles N. of Independence. Considerable work was done here years ago. The vein, though somewhat bunchy, can be traced for nearly a mile. A number of shafts have been sunk upon it, the deepest being about 100 ft. The vein extends N. and S. in granite, and dips nearly vertical. The richer portions of the quartz near the surface are honeycombed, but below it undoubtedly will contain a large amount of iron sulphurets. Nathan Rhine, of Independence, owner.

Josephine Mine (Quartz).—It is about 8 miles S.W. of Darwin and 1 mile from the Mariposa. A great amount of work has been done here, as shown by the numerous long tunnels, shafts, and surface cuts. The vein runs S.E. and N.W., but is quite irregular in dip. The ore carries more copper sulphurets than the Mariposa, but otherwise is very similar. Most of the ore taken from these mines was worked by Mexicans in arrastras years ago. At Coso, half a mile away, there is a 5-stamp mill. J. Wilson, of Lone Pine, owner.

Keys Mine (Quartz).—It is situated on an eastern spur of the Inyo range, 20 miles E. of Independence. The vein occurs in granite, striking E. and W. and dipping N. It is 12 to 20 in. wide. The ore is worked in an arrastra in a cañon to the south. The developments here consist of two inclines, from which drifts have been run on the vein. P. Keys, of Independence, owner.

Keynote Mining Group (Quartz).—They are the *Beauty, Queen, Lone Pine, Mexican, King*, and *El Paso*, and are situated on the sides of Keynote Cañon, on the eastern slope of the Inyo range. The elevation is about 8,000 ft. The mine with the greatest development is the Keynote. The vein runs N. and S. and dips 40° W. It varies from a mere stringer up to 4 ft. in thickness, and carries free gold, a little galena containing silver, and copper and iron sulphurets. This is the deepest mine in the district, being opened 700 ft. on the incline. There are four tunnels, the longest of which is 700 ft.; the longest upraise is 290 ft. In the lowest tunnel a good body of ore was being worked in 1894; the ore was packed 3 miles to the Laskey mill in Hans Cañon. It was opened in 1880. The ore from these claims is similar. J. Laskey, of 1706 Geary Street, San Francisco, owner.

Laura and McAvoy Mines (Quartz).—The Laura Mine lies on the ridge S. of McAvoy Cañon, on the eastern slope of the Inyo range. The vein is a bunchy quartz, apparently pockety in character, and has not been worked for years. North of the cañon are a number of old mines

which have not been worked for several years, and these deposits have also the appearance of being pockety. In the cañon below the mines is a 5-stamp mill.

Luella (*Abe Lincoln*) *Mine* (Quartz).—This mine is situated in the Alabama District, 5 miles N. of Lone Pine. A large amount of work was done here in years gone by, but it was finally abandoned, and it is only recently that it has been relocated. The vein is very small, seldom 6 in. in width, and is inclosed in a fine-grained granite. Most of the ore is free milling. The other small veins in this district have much the same character. See our Xth Report, p. 215. John Basto, of Independence, owner.

Magnet Mine (Quartz).—This mine is situated on Fish Springs Hill, 20 miles N. of Independence. The country rock is granite. The vein runs E. and W. with a nearly vertical dip, and is generally small, sometimes, however, reaching a width of 2 ft. The property is developed by two tunnels, one 110 and the other 500 ft. The quartz carries free gold, and copper and iron sulphurets. It is milled in an arrastra situated about a mile distant.

Mariposa Mine (Quartz).—This is a patented mine in the Coso Mountains, a little N. of the town of Coso. The quartz ledge does not outcrop prominently, but has been worked for nearly 1,000 ft. through five incline shafts, the deepest of which is said to be 250 ft. In the bottom the vein is said to be 4 ft. thick. It strikes very regularly N.W. and S.E. and dips 45° N.E. J. B. Haggin, of New York, owner.

Mazourka Cañon Placer Claims.—They are 7 miles E. of Independence. During the latter part of July, 1894, a small cloud-burst caused to be revealed an abundance of coarse "colors" on a road in the cañon used for years in hauling wood. The gravel is from 6 to 24 in. deep. The gold is coarse, from 10 cents to $10 nuggets; fineness, .876. There were from 70 to 80 men there September 1st, reported to be making from $1 50 to $30 per day. Dry washers are used.

Polita Mine (Quartz).—It is situated on the western slope of the White Mountains, 10 miles E. of Bishop Creek. The mine is at present being worked under a lease. The extensive developments shown here were made under the management of a company, and are a tunnel 400 ft. long, an incline of 250 ft. raised to the surface, and a winze sunk on the ledge 150 ft. The work recently done consists of the sinking of an incline on the ledge, which is well defined and 20 in. thick in the bottom. The vein strikes E. and W. and dips 35° N. The inclosing rock is limestone. The ore is decomposed and free milling, the quartz being honeycombed and often almost replaced by limonite. An arrastra has been recently erected in Redding Cañon, 1 mile S., to work the ore. George Storey, of Bishop Creek, owner.

Post Office Springs Mines (Quartz).—Two miles E. of Post Office Springs, and at an altitude of nearly 5,000 ft. on the Panamint range, are situated three claims on a series of gold-bearing quartz veins. These veins lie in limestone and have a N. and S. course and a dip of 40° to 60° W. The limestone terminates in bold cliffs, 300 to 400 ft. high, facing the N., and exposing the veins. The latter vary from mere stringers to 3 ft. in width. The whole hill in which the veins lie has been affected by the mineralizing agents and filled with minute interlacing quartz veins. Five veins have been opened by short tunnels and surface work. The ore is generally high grade. The quartz is honeycombed

on the surface, but below undoubtedly much of the gold is contained in iron sulphurets. The most important veins are found on the northern claim, which is known as the *Mineral Ranch*. The limestone in which the veins lie is folded in a sharp synclinal, and does not extend to the bottom of the cañon.

Queen Mine (Quartz).—This mine is situated on the eastern slope of Fish Springs Hill, 20 miles N. of Independence. It is developed by a tunnel 225 ft. long. The vein runs E. and W. and dips 25° to 30° N., and is from 2 in. to 2 ft. wide. Antonio Couha, of Big Pine, owner.

Rio Vista Mine (Quartz).—It is in the Fish Springs District and just below the *Golden Reef*. The gold has been found in a mineralized body of granitic rock, poor in mica, and termed by the miners "porphyry." This rock has been crushed, and on the surface appears reddened and honeycombed from the decay of the iron sulphurets. The deposit is apparently of considerable extent, but low grade. It has been opened by a shaft 68 ft. deep and by short tunnels. J. McArthy, of Big Pine, owner.

Sanger Mining Company (Quartz).—The mines of this recently organized company lie on the western slope of the Argus range, 30 miles S. of Darwin. The company controls 23 claims in a diameter of 8 miles. The formation is mostly granite. The ledges are scattered in groups, but are much alike in regard to the character of the ore and in the proportion of the gold and silver. In several claims the value of the silver is said to be greater than the value of the gold. The quartz carries iron and copper sulphurets, gray-copper ore, and occasionally a little galena. Most of the veins are found in the vicinity of Stiles Cañon, where it is the intention to erect a 5-stamp mill. Four tunnels have been run on as many different claims. Mills & Stiles, of Freeman, owners.

Snow's Cañon Gold Mines (Quartz).—They are the Last Chance, St. Paul, and others, and are situated on the eastern slope of the Argus range, 20 miles S.E. of Darwin. They are found on the north side of the cañon, at an average elevation of 5,000 ft. There are many locations here on a series of veins which run N.W. and S.E. The formation is generally granite, which has been forced through the limestone that forms so much of the range to the north. The veins, though small, are generally quite regular and well defined. They vary in size from mere stringers up to 4 ft. The ores are quite similar in character, except toward the east, in the direction of the contact with the limestone, where there is a considerable proportion of silver. On the surface the gold is mostly free, but toward the water-line sulphurets of iron and copper partly replace it. In many places the ore is said to be very high grade. About ten years ago a 5-stamp mill was erected here.

The *St. Paul* and *Last Chance* are the most developed, and are opened by tunnels and shafts, the greatest depth reached being 100 ft. Galena is present at times, and all the veins carry a little silver. A company has recently been organized to work a number of these claims.

Tip Top Mine (Quartz).—It is situated on the summit of Fish Springs Hill. The vein is supposed to be a continuation of that of the Gold Bug, and has much the same character. Upton Tracy, of Big Pine, owner.

Wooley Mine (Quartz).—It is situated on the southern side of Redding Cañon, 10 miles E. of Bishop Creek. There are several narrow stringers of quartz inclosed in granite, and on which a considerable amount of

work has been done. The veins are generally quite flat. — Wooley, of Bishop Creek, owner.

Yellow Jacket Mining Company (Quartz).—The property of this company is situated 12 miles E. of Bishop Creek, in the White Mountain range. Four claims are located here on a vein running N. and S. and inclosed in slate. The claim on which the work is being done was located years ago and finally abandoned. The old workings consist of an incline 63 ft. deep. Two tunnels have been begun by the present owners. The vein, where it has been opened, ranges from 2 in. to 2 ft. in thickness. The ore is high grade and contains a large amount of sulphurets.

KERN COUNTY.

In Kern County there has been a resumption of mining in several localities, the hard times having directed attention to such opportunities for the employment of labor and capital as the mining regions afford. In more than one place extensive bodies of low-grade ore can be traced for several miles, and there are many smaller propositions which seem to offer a livelihood to industrious men. The Kern River flows through one of the principal gold-bearing regions, and presents an unfailing source of water power; it must also be borne in mind that the same stream might be utilized to supply even distant works with electromotive force. There is also an abundant supply of timber throughout a great portion of the mining regions.

The most important mineralogical event during the last two years in Kern County is the discovery of veins of comparatively *pure* asphaltum in the foothills of the Coast Range. A description of these deposits will be found elsewhere in this report.

This county possesses a large area of mineral land and a wide extent of valley land, which, by a very complete system of irrigation, is fast becoming one of the most fertile portions of California.

Agua Caliente Mining District.—This local name is used to designate the territory lying between the most southerly summits of the Pah Ute range and Caliente Creek, and derives its name from the hot springs situated on the Shipsey ranch. The prevalent formation is syenite, which is frequently porphyritic, and in some localities slate occurs. The characteristic geological feature of the district is the numerous trachytic dikes which traverse it. There are many mineral-bearing veins, some of which are worked. The altitude ranges from 2,500 ft. on Caliente Creek to nearly 7,000 ft. in the Pah Ute Mountains. Caliente Creek affords but very little water in the dry season.

Amelia Mine (Quartz).—In the Agua Caliente District. The developments are a tunnel about 60 ft. in length, and a winze about 20 ft. deep. The vein strikes N. 66° W., and dips N. 80°. An open cut, 150 ft. above the tunnel, exposes a vein over 4 ft. in thickness. C. Mohr, of Caliente, owner.

Bald Eagle Mine (Quartz).—It is about 5 miles N.E. of Havilah.

Ballard Mine (Quartz).—This is 5 miles S.W. of Glenville, in the White River Mining District. Burton & Sewell, of Glenville, owners.

Ballard Mine (Quartz).—It is in the White River Mining District. The developments consist of a 100 ft. shaft, a 200 ft. drift, and stopes. The vein is about 2 ft. in thickness, and dips 25° N. The quartz shows sulphurets and free gold. D. B. James, of San Francisco, owner.

Banner Mine (Placer).—This is in Grizzly Gulch, in White River Mining District.

Beauregard Mine (Quartz).—It is on the west branch of the Big Blue vein. See our VIIIth Report, p. 22.

Beaver Mine (Placer).—It is in Grizzly Gulch, in White River Mining District. Wolf & Eby, of White River, Tulare County, owners.

Bella Rufin (*Berry*) *Mine* (Quartz).—In 1893 work was resumed and a new shaft commenced. The vein has a strike of N. 65° W., dipping about 40° S.W. J. B. O'Connor et al., of Visalia, Tulare County, owners.

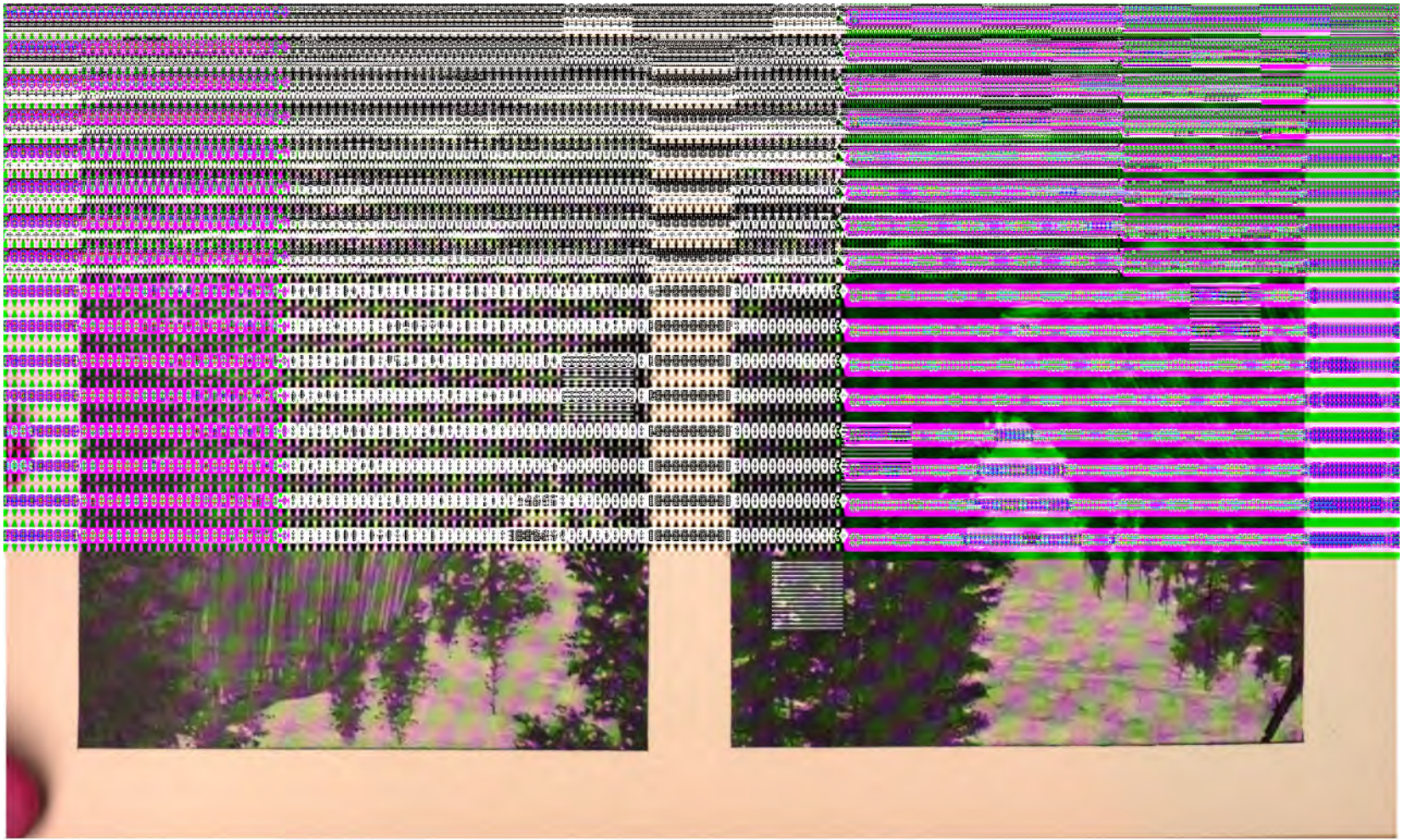
Berry Mine (Quartz).—See Bella Rufin.

Big Blue (*Sumner*) *Mine* (Quartz).—It is on the west bank of Kern River, about 1 mile N. of Kernville. It is a fissure vein, which extends through granitic and slate formations and has a general course of N. 20° E., and dips westerly, and it can be traced 4 miles, or from the southerly extension of the Nellie Dent to the northern limits of the Commonwealth. The apparent outcrop varies from 50 to 150 ft., and it is said that shoots over 50 ft. in width have been struck underground. Two tunnels have been run to strike the vein. The longer commences on the west bank of Kern River, about 250 ft. below the outcrop, and is about 2,000 ft. in length, principally in granitic rock, with a little slate just before reaching the vein. A few feet below the vein there is a clayey gouge about 4 ft. in thickness, and then 8 ft. of barren silicious rock, which constitutes what is regarded as the foot-wall of the main lead, which at this point is about 120 ft. in width. The hanging-wall appears to be altered slate. It is reported that this mine has produced a large amount of gold, and an examination of the property leads to the conclusion that there must be vast quantities of pay ore in the Big Blue which are yet untouched. The only work which has been done on this property for many years is a little tribute working. See our VIIIth Report, p. 315. Prof. T. Price, of San Francisco, owner.

Bob Lee Mine (Quartz).—It is about 2 miles W. of Kernville, and is on a fissure vein, dipping 35° N.E., in granite. The workings consist of three incline shafts, 140, 40, and 100 ft. deep, respectively, from which drifts have been run on the vein. The vein varies in width from a few inches to 2 ft.; its character is earthy, with decomposed clayey matter, interspersed with masses of hard quartz, which sometimes form a large portion of the vein. Nearly all the gold is free. In 1892 a 3½ ft. Huntington mill was erected on a creek about half a mile distant from the mine.

Bright Star Mine (Quartz).—This mine and its extensions are near the summit of Pah Ute Mountain. It is a fissure vein, which strikes S. 30° W.; the general trend of the vein through the different extensions is about S. 55° W. This variation in the strike appears to be caused by a series of southerly displacements, which probably occasioned the "pinching out" in the old workings. The country rock is metaphoric slate, which has a general northerly strike. The last attempt to reopen this mine was made in 1892 by a company organized in St. Louis, Mo., but they appear to have spent their funds without developing anything. Parke & Lacey, of San Francisco, owners.

Brogan Mine (Quartz).—It is in the Agua Caliente District, at an altitude of about 2,800 ft. The workings consist of an open cut 15 ft. deep and a shaft 42 ft., from the bottom of which a level has been run



on the lead about 60 ft. W. In September, 1893, this level was full of water. Shipsey Bros., of Caliente, owners.

Buckhorn Mine (Quartz).—It is in White River Mining District. An 80 ft. shaft on the vein shows 10 in. to 1½ ft. quartz in mica slate walls. W. R. Morris, of White River, Tulare County, owner.

Bullion Mine (Quartz).—It is about 1 mile W. of Claraville. The vein varies from a few inches to 1½ ft. in width, and strikes N. 35° E., in granite. Albert Bartholone, of Onyx, owner.

Bull Run Mine (Quartz).—It is on the west branch of the Big Blue vein. See our VIIIth Report, p. 321.

Canfield Company's Mines (Placer).—This is a recently organized company, located in Bonanza Gulch, 2 miles E. of Red Rock. Fifty-one claims have been bought up, and it is the intention to work them systematically by means of water which will be pumped either from Cohen's Springs or from Red Rock. Canfield Company, of Los Angeles, owners.

Clay Bank Mine (Quartz).—It is a patented claim at Havilah.

Commonwealth Mine (Quartz).—It is a northerly extension of the Big Blue.

Content Mine (Quartz).—It is a southerly extension of the Big Blue.

Dolly Mine (Quartz).—It is a short distance N. of Caliente Creek, and contains three different veins. One of them strikes S. 6° W., and has been prospected by two short tunnels. Another strikes S. 14° W., and the workings consist of an upper and a lower tunnel. The third vein strikes S. 70° W., and has been prospected by a tunnel which is situated at a somewhat higher elevation than the tunnels previously mentioned. Both the hanging- and foot-walls are formed of decomposed porphyritic rock, which near the ore bodies is impregnated by silicious infiltration. A. Souser, of Caliente, owner.

Dreadnaught Mine (Quartz).—This is a western extension of the Grizzly. The developments consist of a 190 ft. tunnel, a 60 ft. and a 35 ft. shaft, partly full of water. The vein varies in thickness from 6 in. to 3 ft., the dip being 45° S. Sulphurets and free gold visible in the quartz. N. Williams et al., of White River, Tulare County, owners.

Eclipse No. 1 Mine (Quartz).—Is in White River Mining District. Developed by a 75 and a 250 ft. shaft. The vein is 2 in. to 2½ ft. wide.

Eclipse No. 3 Mine (Quartz).—It is in the White River Mining District. The vein is 6 to 10 in. in thickness. H. M. Stanley et al., of White River, Tulare County, owners.

Emerald Mine (Quartz).—It is about 10 miles S. of Pah Ute Peak, and is situated in the Agua Caliente District, at an altitude of about 4,700 ft. Developments consist of a tunnel 200 ft. in length connected with a 60 ft. air shaft. The ore has been stoped 15 ft. beneath the tunnel, but deeper working was impeded by water. The strike is N. 8° W. and dip nearly vertical. Shipsey Bros., of Caliente, owners.

Eureka Mine (Quartz).—This mine is about 5 miles S.W. of Kernville, and in the Cove Mining District. The shaft was about 117 ft. in depth. The owner states that the vein, which was first about 3 in. in width, dipping 45° N.E., widened to 12 in. and became nearly vertical at the depth of 100 ft.

Fairmount Mine (Quartz).—See our XIth Report, p. 238.

Frank Mine (Quartz).—On the west branch of the Big Blue vein.

Gold Dollar Mine (Quartz).—It is near the summit of Pah Ute Mountain. The workings consist of two shafts about 35 ft. deep. The vein stands nearly vertical in slate walls, and is from 10 to 12 in. wide. Barney Collins et al., of Weldon, owners.

Goler Consolidated Placer and Hydraulic Mining Company's Mines (Placer).—This company has bonded a large number of claims in the vicinity of the main Goler camp. Here, as in the other camps in this district, there are large areas of gravel for which water is necessary in order to make their working profitable. It is expected that water will be brought from Owens River. (See Preliminary Geological Report on Alpine, Inyo, and Mono Counties.) Goler Consolidated Placer and Hydraulic Mining Company, of Los Angeles, owners.

Grizzly Mine (Quartz).—Is in Grizzly Gulch, in White River Mining District. The developments consist of a 600 ft. and a 300 ft. tunnel, a 150 ft. shaft, an open cut, and several old workings. The vein varies in thickness from 4 in. to 4 ft. It dips 45° S.W. Bates & Duffy, of San Francisco, owners.

Hanover (*Hemp Williams*) *Mine* (Quartz).—It is near the top of the most southerly ridge of the Pah Ute Mountains, and about 5 miles S.W. of Claraville. A tunnel about 65 ft. in length has been run on the vein, which varies from 4 to 10 in. in width; the rock is worked in an arrastra. J. Roper, of Weldon, owner.

Haraldson and Sullivan Mines (Quartz).—Sixteen miles N.E. of Mojave, and on the southern slope of the mountains bordering the desert, a number of claims have been recently located on a body of mineralized granite. The gold-bearing area is said to be several thousand feet in extent from N. to S., and nearly a thousand feet from E. to W. It is very low grade, but it is expected it can be made to pay. In a cañon near by it is estimated there is sufficient water for mill purposes. — Haraldson, of Tehachapi, owner.

Harrison Mine (Quartz).—This is in Keyesville District, on a south extension of the Mammoth. The vein courses N. 45° E., with vertical dip, between granite walls, the quartz carrying galena and iron pyrites with free gold. At a depth of 20 ft., where the influx of water retarded further sinking of the several shafts, a horse of granite divided the 3 ft. of low-grade ore on the hanging-wall from 18 in. of high-grade quartz on the foot-wall.

Havilah District.—Those who have worked what are locally known as the "old mines" of Havilah, are of the opinion that they are by no means exhausted. They are on a mountain side and might be drained and worked advantageously by tunneling, as the center stake of the Rochefort claim is about 1,200 ft. higher than the roadway at Havilah, the distance being 1½ miles in an air line. Kern River, about 6 miles distant, might be utilized to supply works at Havilah with electro-motive power.

Hemp Williams Mine (Quartz).—See Hanover.

Henrietta Mine (Quartz).—It is about 18 miles N. of Caliente, and it is worked intermittently. There are three shafts about 30 ft. in depth, and two tunnels, each about 100 ft. long. The quartz shows sulphurets and free gold. The vein courses nearly E. and W., and varies in width from 1 to 18 in. Both walls are granitic, and there is a clay gouge next to each wall.

Hidden Treasure Mine (Placer).—It is in Gordon Gulch. C. Biggs, of White River, Tulare County, owner.

Hubbard Mine (Quartz).—It adjoins the Emerald on the west, and has a tunnel 150 ft. in length. The vein strikes S. 64° W. and dips 30° S.E. About 50 yds. S.W. of the tunnel some work has also been done on another and parallel vein, which is about 1 ft. wide and strikes N. Shipsey Bros., of Agua Caliente, owners.

Hugh Mann Mine (Quartz).—See Mace.

Iconoclast Mine (Quartz).—It is on Erskine Creek, in Sec. 25, T. 27 S., R. 33 E. The developments consist of two tunnels, with winzes in each. The vein strikes N. 45° E., dips 80° N.W., and varies in width from a few inches to 12 ft. The quartz is more or less decomposed, and is associated with ferruginous and clayey matter. About 100 tons of ore were on the dump. The country rock is slate, which has a strike N. 55° W. Stebbins & Porter, of Havilah (Hot Springs), owners.

Isian Camp Mine (Placer).—It is in Grizzly Gulch, in the White River Mining District, in Sec. 10, T. 25 S., R. 29 E. A. J. Williams, of White River, Tulare County, owner.

Jann Dosie Mine (Quartz).—This is in the Agua Caliente District, at an altitude of 2,975 ft. There are two shafts, 100 and 110 ft. deep, and two levels, one at 30 ft. and the other at the depth of 60 ft. The vein strikes S. 82° W. and dips 60° N.W., in granite. The vein increases from 6 in. at the surface to 5 ft. in width with depth. See our XIth Report, p. 238. Stuter & McKay, of Caliente, owners.

Jeannette Mine (Quartz).—See Mace.

Jeff Davis Mine (Quartz).—It is on the west branch of the Big Blue vein. See our VIIIth Report, p. 321.

Josephine Mine (Quartz).—It is situated in Josephine Cañon, in White River Mining District. The developments consist of a 120 ft. incline, a 40 ft. shaft, and a 40 and a 60 ft. level. The vein varies in thickness from 1 to 8 ft., and dips 65° N.E. The walls are mica slate. The quartz shows sulphurets and free gold. F. A. Bornette, of White River, Tulare County, owner.

Kern River Valley District.—In the mountains forming the sides of this valley there are numerous auriferous ledges, some of which are quite extensive. The Kern River affords an unfailing source of water power. See our VIIIth Report, p. 320.

Keyes Mine (Quartz).—It is in the Keyesville Mining District, and 9 miles S.W. from Kernville. The main vein is very narrow at the surface, but increases to a width of 20 in. The country rock is granitic. S. Barton, of Kernville, owner.

King Mine (Quartz).—It is at the head of Grizzly Gulch, in the White River Mining District. On this claim there is a mass of decomposed granitic rock, permeated with ferruginous matter carrying gold. C. Newby, of White River, Tulare County, owner.

Lady Bell Mine (Quartz).—It is on the west branch of the Big Blue vein.

Last Chance Mine (Quartz).—It is a southwestern extension of the Josephine, in the White River Mining District. Developed by a 60 ft. shaft. The vein is 1 to 1½ ft. wide.

Little Bonanza Mine (Quartz).—This is one fourth of a mile W. of the Mammoth. The vein is 1 to 6 in. wide, carrying a few sulphurets; the walls are granitic.

Little Jim Mine (Quartz).—This is a westerly extension of the Occidental.

Mace and Jeannette Claims (Quartz).—They are 1 mile S.E. of Hanover, at an altitude of about 6,575 ft. The vein varies in width from a few inches to about 1 ft., and strikes N. 40° E.; there are several shafts of less than 100 ft. in depth yielding good ore. Hugh Mann, of Caliente, owner.

Mamie Mine (Quartz).—It is about 5 miles S.W. of Kernville. There is a 60 ft. shaft on the vein, which is 2 ft. wide.

Mammoth Mine (Quartz).—See our VIIIth Report, p. 314. This mine was reopened in 1890, and worked to December, 1892.

Mammoth Mine (Quartz).—This is in the White River Mining District. The developments consist of a 400 ft. and a 200 ft. tunnel, with stopes. The width of the vein varies from 6 in. to 2 ft. The quartz shows sulphurets and free gold. Duke & Grover, of Santa Cruz, owners.

Morning Star Mine (Quartz).—This is an eastern extension of the Grizzly, in White River Mining District. The developments consist of several old shafts and tunnels. The vein shows a thickness from 6 in. to 4 ft. There is a 3½ ft. Huntington mill on this claim. Bates & Duffy, of San Francisco, owners.

Mountain View Mine (Quartz).—This is a western extension of the Eclipse No. 1, in the White River Mining District. The developments consist of a 20 ft. tunnel and a 20 ft. shaft. The vein, only a few inches in width, is said to be rich.

Nellie Dent Mine (Quartz).—See Big Blue.

New World Mine (Quartz).—It is in Havilah; patented. See our VIIIth Report, p. 317.

None Such Mine (Quartz).—This is in Grizzly Gulch, in White River Mining District. The developments consist of a 130 ft. tunnel and an open cut. The vein varies from 6 in. to 3 ft. The quartz shows sulphurets and free gold. A. R. Sorrels, of White River, Tulare County, owner.

Occidental Mine (Quartz).—Near Caliente Creek. There are two shafts about 30 ft. deep on the vein, which shows a thickness of 14 to 24 in., and is a decomposed quartz showing chloride of silver. Drifts have been run both E. and W. for 20 ft. The vein strikes N. 60° W. and dips 80° N. The slate walls are permeated by vein matter. The claim embraces another and smaller vein.

Ophir (Old Bodfish) Mine (Quartz).—It is in the Keyesville District, and 5 miles from Kernville by road. There is a 50 ft. shaft and a 25 ft. drift. The vein strikes N. 35° E. and dips N.W., and is about 5 ft. in width. Both walls are granitic. W. B. Walker et al., of Caliente, owners.

Oriental Mine (Quartz).—It is in Agua Caliente Creek, in the Agua Caliente Mining District. Sauser & Windheim, of Caliente, owners.

Pin-Hook Mine (Quartz).—This is a western extension of the Eclipse No. 1, in White River Mining District. It is said that the developments consist of a 20 ft. tunnel and a 20 ft. shaft. The vein is only a few inches in width, but is said to be rich. P. Womack, of White River, Tulare County, owner.

Polka Dot Mine (Quartz).—It is in Sec. 16, T. 27 S., R. 33 E., in the Valley Mining District, and about 5 miles S.E. from Hot Springs. E. Vaughn, of Havilah (Hot Springs), owner.

Pomona Mill and Mining Company's Mines (Placer).—The claims owned by this company are situated in the Colorado Camp, about 3 miles N. of Goler. It is the purpose of this company to erect a mill here to pulverize the gold-bearing clays and sandstones. It is expected that sufficient water can be developed from a small spring in the gulch at the camp. Pomona Milling and Mining Company, of Los Angeles, owners.

Queen Mine (Quartz).—It is at the head of Grizzly Gulch, in the White River Mining District. On this claim there is a mass of decomposed granitic rock, which is permeated with ferruginous matter carrying gold. F. R. Crocker, of White River, Tulare County, owner.

Rip-Rap Mine (Quartz).—It is about 3½ miles N.W. of the Emerald, at an altitude of 4,580 feet. Developments consist of a 70 ft. tunnel and a 40 ft. winze. In the winze the vein shows about 18 in. of hard quartz and 18 in. of granite mixed with quartz and clay. Both walls are granitic. The quartz breaks, on exposure, into small angular fragments, and carries about 1 per cent of sulphurets. A. J. Skinner, of Weldon, owner.

Rochefort Mine (Quartz).—This is at Havilah.

Sandstone Mine (Quartz).—It is in the White River Mining District. A 40 ft. shaft, partly caved, and an open cut, show a mass of decomposed granitic rock, traversed by numerous ferruginous and gold-bearing veinlets. A. R. Sorrels, of White River, Tulare County, owner.

Santa Fe Mine (Quartz).—In White River Mining District. The vein is said to be 14 in. in thickness. H. M. Stanley et al., of White River, Tulare County, owners.

Sarah Jane Mine (Quartz).—It adjoins the Lady Bell. Developed by a shaft 90 ft. in depth, from the bottom of which levels extend N. and S. about 200 ft. Thede & Medina, of Kernville, owners.

Side Issue Mine (Quartz).—It is S.E. of and adjoins the Iconoclast. Stebbins & Porter, of Havilah (Hot Springs), owners.

Sovereign Mine (Quartz).—It is at Havilah. A small vein has been struck in a tunnel about 80 ft. in length, which will have to be extended to cut the main vein. The croppings vary from 6 to 12 ft. in thickness. Johns and Max Helmes, of Havilah, owners.

Sumner Mine (Quartz).—See Big Blue.

Surprise Mine (Quartz).—It is an eastern extension of the Eclipse No. 1. There are two shafts, 35 and 20 ft. deep. The vein is about 3 ft. wide, and consists of a soft gouge mixed with fragments of quartz. Beaver & Crocker, of White River, Tulare County, owners.

Sycamore Spring Mine (Quartz).—It is in the White River Mining District. The developments consist of a 60 ft. tunnel and a 25 ft. shaft; the vein is about 8 in. wide and pitches about 45° S.W. A. W. Monroe, of White River, Tulare County, owner.

Talc Mine (Quartz).—This is in the White River Mining District. Developed by a 400 and a 250 ft. tunnel, with stopes. The vein varies from a few inches to 1½ ft. There is a 3½ ft. Huntington mill at this mine. G. W. King, of White River, Tulare County, owner.

Urbana Mine (Quartz).—It is on the west branch of the Big Blue vein.

Veracity Mine (Quartz).—It is 1 mile E. of Claraville. In 1893 a 40 ft. shaft was sunk and an 18 ft. drift run on the vein both E. and W. The vein strikes N. 67° E. and dips 65° E. of S., and is about 2 ft. wide, showing considerable free gold and some sulphurets. Both walls are granitic. The claim includes several other veins, from a few inches to

3 ft. in width, which traverse the granite both N. and S. of the one herein described. Barton & Patterson, of Weldon, owners.

Warrington Mine (Quartz).—This is at Havilah.

White Pine Mine (Quartz).—This mine is near Bodfish Creek, which furnishes during the winter and spring considerable water for power. It is a contact vein, the hanging-wall being crystalline limestone and the foot-wall granite, and ranges from 4 in. to 3 ft. in width, and dips 30° S.W. Burton et al., of Kernville, owners.

Woody Mine (Quartz).—It is in Josephine Cañon, in the White River Mining District. The developments consist of three tunnels of 100 ft. and two shafts 50 and 35 ft. The vein is about 1 ft. in thickness. J. Mayfield, of White River, Tulare County, owner.

Yankee Bullock Mine (Placer).—This is in Grizzly Gulch, in the White River Mining District.. B. L. Tompkins, of White River, Tulare County, owner.

LASSEN COUNTY.

This county, from its position on the east side of the Sierra Nevada range, lies entirely outside of the California gold belt proper, and had never been considered as a mining county. Notwithstanding this fact, about twenty-five years ago, near the northern border, very rich veins and seams of gold-bearing quartz were found in altered sedimentary and eruptive formations, elevated above the surrounding lava-covered country, culminating in a hill named from one of its pioneer settlers, Hayden Hill. From this point about $2,000,000 has been extracted from a depth not exceeding anywhere 300 ft. A similar formation may be traced northward into a locality known as Happy Camp, in Modoc County, but nowhere, so far, have paying mines been developed along its course outside of Hayden Hill. Claims have been made that some of the veins in this locality carry platinum, and from the conditions presented it is not likely that a close search might show the presence of gems that have aluminum oxide as their principal constituent. Large masses of a good quality of kaolin are found near the mines, but the distance from railroad communication makes them valueless for the present.

Blue Bell Gold Mine (Quartz).—It is on the W. side of Hayden Hill, adjacent to the village, and comprises 1,500 by 600 ft. The main vein courses E. and W., dips N. about 60°, and is intersected by several cross-veins. The formation is considerably broken up, consisting of altered sandstones and slates. Developments consist of several shafts sunk to a depth of 80 ft.; also open cuts. At present only assessment work is being done. The ore is free milling, and extremely rich in places. E. B. Preston et al., of Hayden Hill, owners.

Brush Hill Mine (Quartz).—This is E. of the village on Hayden Hill, and comprises 1,300 by 600 ft. The main vein, about 4 ft. wide, courses a little S. of W., dips about 55° N., and has conglomerate walls. A second vein runs through the ground N. and S. from the south side of the main vein, with an average width of 2 ft. The property is being worked at two points, through a shaft 45 ft. deep and an east drift 15 ft. long, where the N. and S. vein has been cut, while near the center of the claim a shaft is being sunk 250 ft. to cut the Brush Hill vein proper; this latter shaft (4 by 4½ ft.) is at present down 145 ft. The company own a 10-stamp mill on Willow Creek, 3 miles from the mine, run by an

8 ft. hurdy wheel. The stamps weigh 650 lbs. and drop 68 times per minute, with a 7 in. drop and discharge. The mortar has front and back inside plates, and they use No. 12 slot screens. The duty is three fourths of a ton to the stamp daily. The apron is 6 ft. long, set on a 1¾ in. grade; no concentrators. See our XIth Report, p. 241. F. Vander Elst, of Hayden Hill, owner.

Diamond Mountain Mine (Quartz).—It is 7 miles S. of Susanville, and comprises 1,500 by 600 ft. on the east slope of Diamond Mountain, the vein coursing N.E. and S.W., dipping 45° E., in granite, with a width of 12 in. The quartz is crushed in a custom mill. Developments consist of a shaft on the vein 60 ft. deep.

Don't Care Mine (Quartz).—See Uncle Billy Mine.

Evening Star Gold Mine (Quartz).—It is on Hayden Hill, and is 1,420 by 600 ft. The property comprises several veins: the *Evening Star*, the extension of the *Golden Eagle*, and a vein running parallel with the latter. The Evening Star courses N. 10° W., with a nearly vertical dip, and an average width of 3 ft. The forks of the Golden Eagle extension have a course of N. 75° W. and N. 65° W., respectively, dipping about 50°, and a width, before forking, of 8 ft. The vein parallel to the Golden Eagle extension has a N.W. course, a vertical dip, and is about 1½ ft. wide. The wall rocks are a brecciated felsite. The two latter veins have been traced to their contact with the Evening Star on the east side. The developments consist of a shaft on the Golden Eagle extension, sunk to a depth of 120 ft., with drifts extending west from the 80 and 120 ft. levels for a distance of 150 ft., the ground being stoped to the surface; a main hoisting shaft on the Evening Star, 246 ft. deep, with drifts on the 90 and 120 ft. levels. This shaft is tapped near the bottom by a drain tunnel nearly 1,000 ft. in length. The ground from the 90 ft. level to the south has been stoped to the surface. Several other shafts and cuts have been opened to varying depths along the line of this vein. The ore is free milling; the gold is worth $13 per ounce. Three miles from the mine, on Willow Creek, is a 5-stamp mill, run by a 30 ft. overshot waterwheel; the stamps weigh 650 lbs., and are run at a speed of 85 drops per minute, with 7 in. drop and discharge, using a No. 12 slot screen. The apron is 8 ft. in length, set to a grade of 1¾ in. to the foot. The mine is under lease at present. W. Howard et al., of Hayden Hill, owners.

Gold Belt Mine (Quartz).—See our Xth Report, p. 274. It is 7½ miles S.W. from Susanville, and comprises 1,500 by 600 ft. along a vein coursing N.E. and S.W., with a vertical dip, in granite, averaging from 1 to 3 ft. in width. The quartz is low grade, with a small percentage of sulphurets. Developments consist of a tunnel 180 ft. in length, on the vein. A 5-stamp mill, run by a 5 ft. hurdy wheel, crushes the ore and does custom work. The water power is taken from Gold Run Creek and delivered under 80 ft. pressure. The mill is run at a speed of 95 drops per minute, with 5 in. drop and 4 in. discharge, using a No. 20 steel wire screen. This gives a duty of 1½ tons in twenty-four hours per stamp. The apron is 38 by 28 in., set on a grade 1¼ in. to the foot, and below it a small iron pan with stirrers is used for a settler.

Golden Eagle Mine (Quartz).—This is on Hayden Hill E. of the village, and comprises 1,225 by 600 ft. The 4 ft. vein courses a little N. of W., dipping 65° N., in brecciated rock. The vein matter consists of crushed quartz and clay. Between the foot- and hanging-wall is a horse

of quartzite. The ore on the hanging side is of dark color, due to a large percentage of black oxide of manganese; the ore on the foot-wall is of a grayish color, being largely mixed with clay. The vein enlarges so that in places there are bodies of ore 12 ft. wide. The present workings are at the west end of the claim, and consist of a double-compartment shaft 4 by 7 ft. in the clear, 304 ft. deep, supplied with a horse-whim, with main drifts at the 150 and 220 ft. levels, and several intermediate ones. The 150 ft. level runs W. over 175 ft., and the 220 ft. level extends W. 75 ft., a small stope connecting them. Below the 220 ft. drift a winze has been sunk 50 ft. in solid pay of high grade. On Willow Creek, 2½ miles from the mine, the company own a 5-stamp mill, run by water, and have also leased two others, a 5-stamp and a 10-stamp mill, situated on the same creek. These mills are run by overshot and hurdy wheels, under pressures varying from 26 to 58 ft., with a constant, unfailing water supply from Willow Creek. The company has also two 11 ft. arrastras for working the higher grades of ore. The mills carry 650 lb. stamps, working in double-discharge mortars, with the back discharge closed by a plank supplied with a large silvered plate. The motion varies in the different mills from 80 to 95 drops per minute, with 7 in. drop and discharge through No. 12 slot-cut Russian iron screens. In front of the mortar are 8 ft. aprons the width of the mortar, set on a grade of 1¾ in. to the foot, discharging into a drop box leading to 10 ft. of 20 in. sluices paved with bark riffles. The duty of the stamps is nearly one ton to the stamp. The plates are scraped once a day, and the batteries cleaned up every two weeks. The loss of gold passing off with the muddy, clayey water is quite large, but accurate data through assays have not been obtained. Dr. Schlosser et al., of Hayden Hill, owners.

Golden Eagle Extension (Quartz).—See Evening Star.

Gopher Gold Mine (Quartz).—This is on Hayden Hill, one fourth of a mile S.E. from the village, and comprises 1,500 by 600 ft. on an E. and W. vein, dipping nearly vertical, several feet in width, between sandstone and breccia. Developments consist of a shaft sunk on the foot-wall of the vein, exposing a pay seam 8 in. wide. W. Dale et. al., of Hayden Hill, owners.

Hayden Gouge Claim (Quartz).—See Uncle Billy Mine.

Hayden Hill Consolidated Tunnel Company (Quartz).—This is about half a mile E. from the village on Hayden Hill, and is a tunnel-right containing 3,000 ft., and four full mining claims. The tunnel has attained a length of 1,025 ft., timbered throughout, and is ventilated by a fire-blast. The formations passed through are sandstone and quartzite. Eight hundred feet from the mouth of the tunnel a mineralized belt 30 ft. wide was cut, carrying numerous quartz seams, having a general E. and W. course. Nearer the breast of the tunnel other small quartz seams have been cut. Hayden Hill Consolidated Company, owners; N. Bieber, of Bieber, Secretary.

Juniper Gold Mine (Quartz).—This is west of the town, on Hayden Hill, and comprises 1,500 by 600 ft. There are two veins on the claim, a N. and S. and an E. and W. vein, the developments being confined to the latter near the crossing with the former. The N. and S. vein has a width of about 1 ft.; the other vein varies from 2 to 40 ft. between the walls, which are brecciated on the hanging and fine-grained rhyolite on the foot. The vein matter consists of quartz stringers mixed with

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Champion Mine (Quartz).—It is in Mount Gleason Mining District. See Mount Gleason, and our VIIIth, IXth, and XIth Reports, pp. 332, 195, and 247. S. Black, of Acton, owner.

Eagle Mine (Quartz).—See Mount Gleason District, which it is in. It has a strike of 10° N. A 5-stamp mill was in operation in the spring of 1894. The water supply was too limited for more expensive operation. See our VIIIth, IXth, and XIth Reports, pp. 332, 195, and 247. E. Beckman, of Santa Barbara, owner.

Last Chance Mine (Quartz).—It is in Cedar Mining District, 3 miles W. of Acton. E. Brough, of Acton, owner.

Loris Mine.—It is on the southern slope of the Sierra Madre Mountains, 4 miles N. of Pasadena. The workings are chiefly in a ferruginous metamorphic rock, from 1 to 4 ft. wide. They are erecting reduction works at the foot of the mountain, 1,400 ft. below. Their process is secret, and all information concerning it was refused. Loris Gold Mining Company, owners; E. Kennedy, of Pasadena, President.

Mount Gleason District.—It is 7 miles S.E. from Acton, on the S. P. R. R., 55 miles from Los Angeles. There are several claims on the two veins in the district, the Eagle and the Padre, which unite in the Padre claim. Geologically and mineralogically all the veins of this district have a marked similarity, occurring in granite, being nearly perpendicular. In width they range from 1 to 6 ft. The quartz is shattered and contains sometimes as much as 10 per cent of auriferous iron sulphurets. The rock near the surface is oxidized and porous, and is free milling. The granite is remarkable and of unusual interest because of the large amount of labradorite feldspar it contains and the small amount of mica and hornblende.

Newhall Placers.—On each side of Soledad Cañon, and E. of Newhall, are extensive deposits of gravel containing gold. They also extend W. along the Santa Clara River for miles. They lie in terraces, which mark the successive flood plains of an ancient river which flowed S. from the Mojave Desert. The gold is generally fine, but occasionally coarse. The gravel is partly cemented by a small amount of carbonate of lime and clay. The upper portion of the beds, from 1 to 6 ft., is iron-stained, and in places contains gold in paying quantities. In the small gulches cutting into this surface stratum good pay is frequently found. The top stratum pays from 5 to 25 cents per cubic yard. The material composing the gravel is all foreign, and is similar to that forming the great conglomerate deposits lying between Langs and Ravenna stations of the S. P. R. R. This conglomerate may also be the source of the gold. See our VIIIth, IXth, and XIth Reports, pp. 333, 201, and 248.

New York Mine (Quartz).—It is in Cedar District, 3 miles W. of Acton. See our VIIIth, IXth, and XIth Reports, pp. 332, 192, and 247. Thos. O'Reilley, of Ravenna, owner.

Padre Mine (Quartz).—It is in Mount Gleason District, 7 miles from Acton. See Mount Gleason, and our VIIIth Report, p. 332. Judge Nickel, of Acton, owner.

Placerita Mines (Placer and Drift).—See our VIIIth, IXth, and XIth Reports, pp. 333, 201, and 248.

Reberg, Geo., Mine (Quartz).—It is in Arrastra Cañon, about 10 miles E. of Newhall. The developments consist of several short tunnels and shallow shafts. The vein, although only a few inches in width, is rich in free gold; it is worked in an arrastra.

Red Rover Mine (Quartz).—It is in Cedar District, 3 miles W. of Acton. It has a shaft 400 ft. deep and an incline on the vein 200 ft., and is the most productive mine in the district. Operations were resumed in September, 1894, after a suspension of two years, the incline being retimbered throughout. The geological features of the mine are peculiar. The vein occurs in a dark green, massive crystalline rock. There are two main fissures, 10 to 20 ft. apart. All the rock between these fissure planes is crushed, and most of it altered and compressed into chloritic schist. This constitutes the lode, within which the shoots of gold-bearing quartz occur. These form on or near the foot-wall side of the lode and downward and along the lode to the west approaching the hanging-wall, but cut off before reaching it by a mass of country rock, which reaches from wall to wall of the lode. There is a succession of these shoots, each 40 to 65 ft. in height, the floors being 6 to 15 ft. thick. There are two separate series of shoots. The mine is equipped with steam hoist and a 10-stamp mill. See our VIIIth, IXth, and XIth Reports, pp. 332, 191, and 246. E. B. Millar, of 141 Broadway, Los Angeles, owner.

San Francisquito Mines (Placer).—See our VIIIth, IXth, and XIth Reports, pp. 333, 201, and 248.

Santa Paula Mine (Quartz).—It is in Cedar District, 1½ miles W. of Acton. It is a small vein that has been worked off and on for years. G. Cruger, of Acton, owner.

Savage Mine (Quartz).—It is in Cedar District, 5 miles W. of Acton. The croppings consist of immense masses of ferruginous quartz, interstratified with a granular talc rock. The quartz bodies are from 10 to 50 ft. wide, the whole mass being 120 ft. or more in width. A cross-cut tunnel, 40 ft. from the surface, passes through 30 ft. of solid quartz. It is said that all the quartz is gold-bearing. There is neither fuel nor water convenient. Mr. Savage, of Monrovia, owner.

Soledad Placers.—See Newhall.

Topeka Mine (Quartz).—It is in Cedar District, 3 miles W. of Acton. See our XIth Report, p. 247. E. B. Millar, of 141 Broadway, Los Angeles, owner.

Union Mine (Quartz).—It is in Cedar District, 5 miles W. of Acton. F. Chase et al., of Whittier, owners.

MADERA COUNTY.

The northeastern part of the county, or the Grub Gulch region, is once more the field of active mining operations.

The mines in the southeastern portion of Madera County are in Hildreth, Fresno, and Potter Ridge mining districts, in Jackass Mountain, and in the Minarets. It is also reported that there are large bodies of ore near the borders of Mono County, and in the territory reserved as "The Extension of the Yosemite Park."

Most of the mines in the portion of Madera County referred to are worked intermittently and in a desultory fashion. The ore is usually treated in a horse arrastra. The ore from some of the mines yields more than $25 a ton by this method. The sulphurets are disregarded, and probably a large portion of the precious metals which the ores contain is lost. It is possible that the "cyanide process" may be well adapted for the class of ores mined here.

Abbey Mine (Quartz).—It is in Sec. 36, T. 9 S., R. 21 E., and has been extensively worked, the ore being treated in a 10-stamp mill and in chlorination works. See our VIIIth and Xth Reports, pp. 202 and 194. G. W. Grayson, of San Francisco, owner.

Achsah D. Mine (Placer).—It is in Fine Gold Gulch, in Sec. 25, T. 10 S., R. 21 E. C. B. Holstead, of Pollasky, Fresno County, owner.

Albion Mine (Quartz).—This mine is in Swede Gulch, Potter Ridge Mining District. The vein shows a width of about 12 in. in the open cut and prospect shaft. T. Keefe and J. Logan, of Coarse Gold, owners.

Alexandra Mine (Quartz).—This is in Potter Ridge District. The vein is 18 in. wide. G. A. Krohn, of Coarse Gold, owner.

Alpha No. 2 Mine (Quartz).—This is in Potter Ridge District. The vein is reported to be 3 to 10 ft. wide. Developments consist of an old 80 ft. shaft. Waterloo Gold Mining Company, of San Francisco, owners.

Alvarita Mine (Quartz).—It is in Hildreth District. Workings consist of a short incline and an open cut on an 18 in. vein. W. Reed, of Pollasky, and Alva E. Snow, of Fresno, owners.

Aurora Mine (Quartz).—It is in Potter Ridge District. F. Dirks, of Coarse Gold, owner.

Baltimore Mine (Quartz).—It is at Jackass Mountain, and has a 400 ft. tunnel with a 28 ft. winze and a 60 ft. air shaft. The vein is about 2 ft. wide, with a pay streak 6 to 18 in. wide. It dips 70° N.W. Smith Norris, of Fresno, owner.

Bandarita Mine (Quartz).—In Hildreth District. D. Pray and G. W. Dean, of North Fork, owners.

Bass Mine (Quartz).—It is in Potter Ridge District. The vein is 6 to 10 in. wide. D. R. McKenzie and F. Rhule, of O'Neals, owners.

Bazinet (Morrow) Mine (Quartz).—It is in Sec. 25, T. 9 S., R. 21 E. Workings consist of a 200 ft. and a 275 ft. tunnel. The vein varies from 1 to 2½ ft. in width, and dips at an angle of about 45° S.W. See our Xth Report, p. 195. P. Bazinet, of Hildreth, owner.

Belleview Mine (Quartz).—This claim is in Sec. 18, T. 10 S., R. 21 E. The 60 ft. and 150 ft. tunnels expose a 12 in. vein, which carries some sulphurets. — Besone, of Coarse Gold, owner.

Berry Mine (Quartz).—This is in Hildreth Mining District. There are three shafts, 60, 70, and 140 ft. deep, nearly filled with water. The 12 in. vein strikes S.W. in granite. L. V. Loomis and J. E. Falconer, of O'Neals, lessees.

Bessie H. Mine (Quartz).—This is in Fine Gold Gulch, in Sec. 25, T. 10 S., R. 21 E. E. Wright, of Pollasky, Fresno County, owner.

Blind Orphan Mine (Quartz).—It adjoins the Stemwinder on the west, at Jackass Mountain. In the 20 ft. shaft the vein is about 14 in. wide, and dips about 60° N.W. The quartz carries sulphides of iron and lead. G. D. Hitchcock and P. Sinas, of Madera, owners.

Bowlder Mine (Placer).—This is on Fine Gold Creek, in Sec. 26, T. 9 S., R. 21 E. J. M. Bowles, of Hildreth, owner.

Buena Ventura Mine (Quartz).—It is in Potter Ridge District. The vein is 16 in. wide. Thos. Strombeck et al., of Coarse Gold, owners.

Burney Mine (Quartz).—In Potter Ridge District. Developments consist of 180, 100, and 70 ft. shafts, with drifts from the bottom of the deepest, which are 220 and 60 ft. long. The vein is 18 in. wide. D. McClellan and C. Melvin, of Coarse Gold, owners.

Butterfly Mine (Quartz).—This is three fourths of a mile W. of the Savannah, in mica schist. Four tunnels 100 ft. apart have been run on the vein, which strikes N. 50° W. and dips 50° N.E. A granitic dike accompanies the vein, both vein and dike cutting the inclosing slates in dip, but conforming closely with them in strike. The vein, quartz, about 14 in. wide, is crystallized, and contains quite a large percentage of iron sulphurets, which carry gold. W. A. Poole, of Grub Gulch, owner.

Caledonia Mine (Quartz).—In Potter Ridge District. The vein, in the two open cuts, varies from 1 to 1½ ft., showing free gold. D. McClellan et al., of Coarse Gold, owners.

Canady Mine (Quartz).—This claim is in Sec. 19, T. 10 S., R. 21 E. Two shafts, partially filled with water, expose a 3 ft. ledge, dipping 45° W. in granite. A. J. Cassidy, of Pollasky, Fresno County, owner.

Caroline Mine (Quartz).—It is in Swede Gulch, Potter Ridge District. The prospect shaft and sundry open cuts show the vein is about 18 in. wide, carrying some sulphurets. J. Jones and F. C. Nimes, of Coarse Gold, owners.

Central No. 2 Mine (Quartz).—On the North Fork of Deadwood Creek; is opened by an 80 ft. tunnel on a 10 in. vein, which shows sulphurets. D. McClellan and C. Melvin, of Coarse Gold, owners.

Chipmunk (*Stargo*) *Mine* (Quartz).—In Sec. 15, T. 9 S., R. 21 E. D. L. Pray, of North Fork, owner.

Cliff Mine (Quartz).—This claim is at Jackass Mountain. Developments consist of 40 and 60 ft. tunnels. The vein varies in width from a few inches to 4 ft. The quartz contains sulphurets, which are roasted in heaps and then worked in an arrastra. P. Ralph, of North Fork, owner.

Colorado Mine (Quartz).—This is a N.W. extension of the Caroline. The 15 ft. shaft exposes a vein nearly 2 ft. in width. D. McClellan et al., of Coarse Gold, owners.

Columbus Mine (Quartz).—This claim is on the North Fork of Fine Gold Creek, in Potter Ridge District, and is developed by open cuts. J. Morrison and F. Nimes, of Coarse Gold, owners.

Combination Claim (Placer).—This is on Fine Gold Creek, and in Sec. 25, T. 9 S., R. 21 E. J. W. Strathan, of Hildreth, owner.

Contention (*Rough and Ready*) *Mine* (Quartz).—In Hildreth District. Developments consist of a tunnel and drift more than 100 ft. in length, and a shaft 130 ft. in depth. The thickness of the vein varies from a few inches to about 3 ft., and pitches 30° S. The quartz is worked in a horse arrastra. The ore containing the most sulphurets is roasted in heaps. T. Keefe and T. W. Taylor, of O'Neals, owners.

County View Mine (Quartz).—It has a tunnel 1,300 ft. long, and a 26 ft. vein between the walls. See our VIIIth Report, p. 213. D. McClellan and Chas. Melvin, of Coarse Gold, owners.

Crabtree Mine (Quartz).—This is on the North Fork of Fine Gold Creek, Potter Ridge District. A small shaft and open cuts show a vein about 14 in. wide, carrying free gold. T. Jones, of Coarse Gold, owner.

Crescent Mine (Quartz).—The open cut shows a vein about 2½ ft. in width. G. Conklin and H. McCarthy, of Coarse Gold, owners.

Cross Mine (Quartz).—Open cuts show a vein about 1½ ft. in width. G. Conklin and H. McCarthy, of Coarse Gold, owners.

Crystal Spring Mine (Quartz).—See our VIIIth Report, p. 214. I. M. Knox, of San Francisco, owner.

Dagmar Mine (Quartz).—In Potter Ridge District. An open cut shows the vein 18 in. wide. Chris. Petersen and T. Jones, of Coarse Gold, owners.

Defiance Mine (Placer).—This is at the Old Adobe crossing on the San Joaquin River. J. Petersen, of North Fork, owner.

Diana Mine (Quartz).—This is in Sec. 18, T. 10 S., R. 22 E. There are three tunnels, the longest of which is more than 400 ft. in length. W. R. Hampton, of Pollasky, Fresno County, owner.

Eighty-four Mine (Quartz).—In Potter Ridge District. A 20 ft. shaft has been sunk on the vein, which can be traced on the surface, and shows a width of 1 to 8 ft. D. R. McKenzie and F. Rhule, of O'Neals, owners.

Eighty-six Mine (Quartz).—It is in Sec. 36, T. 9 S., R. 20 E. The workings consist of four shafts varying from 20 to 100 ft. in depth. The vein is said to be from 2½ to 7 ft. wide, and pitches about 50° N.E. A cross lead intersects the lode, and is about 5 ft. wide, within granitic walls. C. J. Beck, of Zebra, owner.

Eliza Jane Mine (Quartz).—This is in Sec. 25, T. 9 S., R. 21 E. The developments consist of five tunnels, which aggregate probably 500 ft. in length, and an 80 ft. incline. The vein varies from 1 to 2 ft., within granitic walls. P. Bazinet, of Hildreth, owner.

E. R. Daniels Mine (Quartz).—In Hildreth District. In the 15 ft. shaft the vein is about 1 ft. wide. E. R. Daniels and R. Higgins, of Pollasky, Fresno County, owners.

Fine Gold Mine (Quartz).—It is in Fine Gold Gulch, about 3½ miles N.E. of O'Neals P. O. Mark Anderson, of O'Neals, owner.

Fine Gold Claim (Placer).—It is in Sec. 25, T. 9 S., R. 21 E. J. Kirby, of Hildreth, owner.

First Venture Mine (Quartz and Placer).—These claims are situated in Sec. 21, T. 9 S., R. 21 E. I. L. Baker, of O'Neals, owner.

Five Oaks Mine (Quartz).—This embraces three claims, viz., Sydney, Alpha No. 1, and Eclipse, which adjoin and are in Potter Ridge District. Developments consist of two tunnels 400 and 170 ft. long and two shafts 70 and 40 ft. deep. The vein is 25 ft. wide and dips 35° N.E. Five Oaks Mining Company, of San Francisco, owners.

Fresno Banner Mine (Quartz).—In Hildreth District. J. Donahoe et al., of Fresno, owners.

Fresno Enterprise Mine (Quartz).—It is 4 miles E. of Grub Gulch, on the south side of Fresno River, and on the east slope of a mountain called Potter Ridge. The vein occurs in mica slate, accompanied by granitic dikes. It strikes W. of N. and dips 80° E. The upper portion of the vein is bent over by the weight of the mountain, dipping to the W. The quartz is granular and glassy, and contains iron sulphurets. Gay Coats, of Pasadena, Los Angeles County, owner.

On the same side of the mountain is a contact of diabase and mica slate which has never been explored. Southward are some small prospects where the rock is worked in arrastras.

Grand Central Mine (Quartz).—In Potter Ridge District. Developments consist of two shafts, one 40 and the other 18 ft. deep. The vein is 18 in. wide, showing sulphurets and free gold. D. McClellan et al., of Coarse Gold, owners.

Great Eastern Mine (Quartz).—In Potter Ridge District. The vein is about 15 in. wide. D. McClellan and Chas. Melvin, of Coarse Gold, owners.

Grub Gulch Region.—The gold mines here occur in the belt of crystalline schists which extends south into the granite from the Sebastopol Mine, 4 miles S.E. of the town of Mariposa, into Madera and Fresno counties. The west granite areas strike S. across the edges of the slates and schists; the direction of the line of contact is N. 65° to 70° W., and the strike of the slates N. 50° to 60° W., while still east of the area is another, in which the slates strike N. 45° W. The line of contact between these two metamorphic areas is well defined and marks the general course of the principal mineral lode or vein system of the district. The west area consists of mica slates, micaceous sandstones, mica schists, talcose and chloritic schists, and eruptive dikes of granitic character, and a mass of diabase of irregular form. The east series consists of an evenly laminated, firm mica slate, called the "Indian Peak" slate. The veins occur along and near the contact of the mica slates of the east series and the mica schists and magnesian rocks of the west series. Ordinarily the veins form in the west series and strike across the inclosing rocks to the contact, where they turn and follow it or pinch out entirely. The contact is usually accompanied by a crushing and splitting of the rocks along its course, and in this zone are found many seams and bunches of quartz rich in gold. A fact noticeable in this district appears of importance, viz.: That with the exception of the small, short shoots of gold-bearing quartz found in the micaceous and magnesian schists of the contact, no veins of value were found in the rock other than the mica slates. This phenomenon has been observed elsewhere.

Hall Claim (Placer).—It is on the North Fork of the San Joaquin. W. Hall, of North Fork, owner.

Hanover Mine (Quartz).—This claim is in Sec. 31, T. 9 S., R. 22 E. The workings consist of a shaft and two tunnels. The vein shows an average thickness of about 1 ft., in granitic walls. There is a 5-stamp mill, and hoisting works. See our VIIIth Report, p. 204. H. S. Williams, of Raymond, owner.

Harrietta Mine (Quartz).—It is in Swede Gulch, Potter Ridge District. An open cut exposes a 14 in. vein, showing sulphurets. H. McLeran, of Coarse Gold, owner.

Hawkeye Mine (Quartz).—This claim is at the head of Swede Gulch, Potter Ridge District. The developments consist of a 200 ft. tunnel and a 60 ft. shaft. The vein varies from 1 to 16 in. in width. D. McClellan et al., of Coarse Gold, owners.

Henrietta Mine (Quartz).—This is an easterly extension of the Lottie K, and is on the east bank of Fine Gold Creek, in the Hildreth District. The workings are as follows: A lower tunnel 190 ft. in length, in which the vein varies from a few inches to 2 ft., and dips 40° N. of W. About 60 ft. above there is an incline 70 ft. in depth sunk on the vein. About 50 ft. above the incline there is a 40 ft. tunnel. In this tunnel the vein seen in the lower workings, and a smaller vein running parallel thereto, are exposed. The ore is clean quartz, showing a small amount of sulphurets. The walls are granitic. J. A. Harris and W. Reed, of Pollasky, owners.

Hesper Claim (Placer).—This is situated in Sec. 25, T. 9 S., R. 21 E. J. P. Newman, of Hildreth, owner.

Hildreth and Fresno Mining Districts.—The dividing line between the Hildreth and Fresno mining districts is Fine Gold Creek, and all the mines in Fresno Mining District are east of it. Many of the mines in these districts are situated near a dike coursing N.E. and S.W., which culminates in a mass of eruptive rock forming the crest of Crook's Mountain, at an altitude of about 2,000 ft. A review of the strike and position of the gold-bearing veins on the southeastern side of the dike shows that they run practically parallel to the dike, and are situated at no great distance from it. It is said that on the northwestern side of the dike the principal leads of pay ore have a course of about N. 74° E., and that although there are strong cross leads, they are usually barren, except at points of intersection, where bodies of high-grade ore are frequently discovered. Those who are acquainted with the deepest workings in the Hildreth District state that the silver value of the ore increases and the gold value wanes as a great depth is reached. In other portions of Fresno and Hildreth mining districts the veins occupy fissures in the granitic rocks; the latter sometimes present a gneissoid structure.

Hildreth Mine (Quartz).—This is in Sec. 36, T. 9 S., R. 21 E. The developments consist of a 400 ft. incline, from which stopes extend for about 200 ft. E. The vein is somewhat irregular, and varies from a few inches to 3 ft. in width. The quartz shows but few sulphurets. Heirs of W. Dunphy, deceased, of Hildreth, owners.

Hoboken Mine (Quartz).—In Potter Ridge District. The developments consist of a 100 ft. shaft and 60 ft. drift; the vein is from 4 to 6 ft. wide, carrying sulphurets and free gold. The Collector and Treasurer are extensions, having the same features, and all are owned by L. Krohn, of Coarse Gold.

Homestake Mine (Quartz).—This is in Sec. 19, T. 10 S., R. 22 E., in Hildreth District. There are two inclines, said to be 115 and 160 ft. deep, respectively, with drifts and stopes leading therefrom; also a shaft 80 ft. deep. The vein is 2 to 6 ft. wide, between granite walls, and dips 45° N.W. Wise & Brennan, of Hildreth, owners.

Hughes Mine (Quartz).—It is in Sec. 30, T. 9 S., R. 22 E. Developments consist of tunnels, drifts, etc., probably 500 ft. of work in all. R. Williams, of Hildreth, owner.

Indian Peak Mine (Quartz).—South of the Mammoth, and prospected by shallow cuts and trenches. Chas. Ward, of Grub Gulch, owner.

Jackass Mountain Mines.—The surface of the country rock in the vicinity of Jackass Mountain presents a smooth and rounded contour. The depression in which Jackass Meadows are situated was no doubt at one time occupied by a chain of small lakes; indeed, a small lake still remains at the southern base of Jackass Mountain. The veins are gold-bearing fissures in granitic and granular quartzose rock, containing some mica, but in which little or no feldspar can be seen by macroscopic observation.

Joe Mine (Quartz).—This property is a mile S. of Fresno River, on a high peak 600 ft. above the river. The vein consists of a zone of contorted and shattered mica schists, into which has infiltrated a large amount of quartz in the form of stringers, lenses, and veins; some of the latter are 12 in. in width. The entire mass, 6 to 12 ft. in width,

contains gold. The workings in 1893 consisted of two shafts, one 200 ft., the other 125 ft. deep; a connecting drift, 150 ft. in length, and a drift south of the main shaft at the 100 ft. level. Provided with arrastras. J. Spencer, of Grub Gulch, owner.

Josephine, Arkansas Traveler, and Gambetta Mines (Quartz).—They are on the west side of the metamorphic area, half a mile from Grub Gulch. See our VIIIth and Xth Reports, pp. 213, 197, and 202.

Keefe Mine (Quartz).—It is in Deadwood Gulch, Potter Ridge District. There is a small shaft and several open cuts, showing a vein 6 in. wide, carrying free gold. T. Keefe, of Coarse Gold, owner.

Keno Mine (Quartz).—This adjoins the Melvine, in Potter Ridge District. An open cut shows a 15 in. vein. M. A. Kipperdan and G. G. Murray, of Coarse Gold, owners.

Last Chance Mine (Placer).—This claim is at the Old Adobe crossing on the San Joaquin River. J. F. Hutchinson, of North Fork, owner.

Last Chance Mine (Quartz).—This claim is in Sec. 14, T. 8 S., R. 21 E. Developments consist of an upper and a lower tunnel, each of which is about 700 ft. in length. In the upper tunnel, which is partly caved in, the vein is 1 to 5 ft. wide and pitches about 60° N.E. The lower tunnel does not appear to have been run on the vein. At this mine there is a 10-stamp mill. See also our VIIIth and Xth Reports, pp. 211 and 201. D. R. McKenzie and F. Rhule, of O'Neals, owners.

Last Chance Mine (Quartz).—This is in Sec. 30, T. 9 S., R. 22 E. The vein is 1½ ft. in width, between granitic walls. C. Williams, of Hildreth, owner.

Laura May Mine (Quartz).—In Deadwood Gulch and Potter Ridge District. Open cuts expose the vein 1 to 1½ feet in width. The *Montana* is an extension, with same characteristics. Both are owned by D. McClellan et al., of Coarse Gold.

Lawsuit Mine (Quartz).—This adjoins the Bazinet, in the Hildreth District. The two tunnels are 200 and 260 ft. in length, and the vein is 1 to 2 ft. wide and dips 45° S.W. P. Bazinet, of Hildreth, owner.

Lewis Mine (Placer).—This claim is situated in Sec. 1, T. 10 S., R. 21 E. B. T. M. Lewis, of Pollasky, Fresno County, owner.

Lillie Mine (Quartz).—The mine is in Sec. 27, T. 9 S., R. 21 E. There is a shaft 400 ft. deep, with drifts and stopes running therefrom. The vein shows a width of from 2 to 3 ft. between granitic walls. The mill at this mine burned down in 1893. See our VIIIth Report, p. 210. McDonald Bros., of San Francisco, owners.

Lingo Mine (Quartz).—This is in Swede Gulch, Potter Ridge District. It is opened by two tunnels, 100 and 60 ft. in length. The vein is about 12 in. wide. J. Lingo, of Coarse Gold, owner.

Little Willie's Mine (Placer).—This claim is in Fine Gold Gulch, in Sec. 25, T. 10 S., R. 21 E. G. P. Gunter, of Pollasky, Fresno County, owner.

Little Wonder Mine (Quartz).—In Potter Ridge District. There is a 40 ft. incline. The vein varies from 8 to 14 in. in width. The *Crown Point* and *Nondescript* are the same in character, and all owned by D. McClellan and Chas. Melvin, of Coarse Gold.

Lottie K Mine (Quartz).—This mine is in Sec. 14, T. 10 S., R. 21 E., on the west bank of Fine Gold Creek. The workings consist of three tunnels, the lowest of which is about 40 ft. above the creek, and is 180 ft. in length. The ledge between the walls is rather more than 3 ft.

wide, and dips 45° S.W., and there is a pay streak about 18 in. wide next to the hanging-wall. The middle tunnel is about 90 ft. above the creek, and is 160 ft. in length on the ledge. An incline connects the two tunnels. The middle tunnel has been run on a small vein with high-grade ore, and dips in a similar direction to that of the larger vein, but its angle of inclination is less. The upper tunnel is on the small vein; is about 140 ft. above the creek, and is 150 ft. in length. There is a spring of good water in the mouth of the upper tunnel. J. A. Harris et al., of Pollasky, Fresno County, owners.

Lucky Day Mine (Quartz).—It is in Greason Gulch, Potter Ridge Mining District. A shallow shaft shows a vein about 1 ft. wide. T. Kipperdan, of Coarse Gold, owner.

Lucky Star Mine (Quartz).—In Hildreth Mining District. R. Stayton et al., of O'Neals, owners.

Mabel Mine (Quartz).—The workings consist of an open cut about 45 ft. in width. W. F. Roddick et al., of Fresno, owners.

Madera Mine (Quartz).—This claim is in Fresno Mining District. One of the owners states that the developments consist of a 90 ft. incline, and that the vein is about 4 ft. in width, showing sulphurets and free gold. A. Cadoza et al., of O'Neals, owners.

Mammoth Mine (Quartz).—This is in King's Gulch, 1 mile N. of Grub Gulch, at the north end of the Mammoth lode. The main vein is 20 to 25 ft. in width, striking N. 70° W. and dipping 45° N.E. On the foot-wall side are a number of smaller veins, 4 or 5 ft. in width, which strike into the main vein. The hanging-wall of the lode is mica slate; the foot-wall is a much decomposed granitic rock of fine texture, probably granulite. A transverse fracturing of the vein is a very pronounced feature of this portion of the lode. It is probably due to the movement of the country subsequent to the formation of the vein. The Mammoth lode, on the northern end of which the Mammoth Mine is located, has been traced for 15,000 ft., and it may be longer. It is accompanied throughout its entire length by an intrusive granitic dike, the texture of which ranges from felsite to micro-granite and granulite, and south of Fresno River it approaches pegmatite in the coarseness of its crystallization. This dike crosses the vein system in several different places. Since the visit of the field assistant this mine has been developed to a depth of 200 ft., and an electric plant, transmitting power from Fresno River, 1½ miles, is in operation. Charles Ward, of Grub Gulch, owner.

Manzanita Mine (Quartz).—It is in Hildreth District. Developments consist of an 84 ft. incline and open cuts. The vein shows an average width of 1½ ft. The quartz shows some sulphurets, frequently occurring in bunches. R. P. Brownell, of Hildreth, owner.

Margarite Mine (Quartz).—This mine is in Fine Gold Gulch, Hildreth District. Developments are an incline shaft 180 ft. deep, from which a 20 ft. drift has been run on the vein at a depth of 130 ft. The vein shows a width of from 6 to 18 in., and dips to the N.E. At the mouth of the shaft the angle of inclination is about 25°, but it increases to 60° at the bottom of the workings. The quartz is somewhat decomposed, and the harder portions show a few sulphurets. Chas. Baker et al., of O'Neals, owners.

May Flower Mine (Quartz).—This claim is on the southeast branch of Fine Gold Creek, in Hildreth District. The tunnel is 200 ft. long, and the ledge is from 2 to 3 ft. wide.

Miller & Holt Mine (Placer).—It adjoins the Hall claim on the north. Miller & Holt, of North Fork, owners.

Miller, L. H., Mine (Quartz).—This claim is in Sec. 19, T. 10 S., R. 21 E. It has an incline 40 ft. deep. The vein is about 18 in. in width, and dips 50° S.W. between granitic walls. L. H. Miller et al., of Pollasky, Fresno County, owners.

Mint Mine (Quartz).—It is in Swede Gulch, Potter Ridge District. Chris. Petersen and T. Jones, of Coarse Gold, owners.

Monitor Mine (Quartz).—This is in Cabin Gulch, in T. 7 S., R. 20 E. The shaft is only 25 ft. deep. Chris. Petersen and J. Krohn, of Coarse Gold, owners.

Morning Star Mine (Quartz).—It is in Deadwood Gulch, Potter Ridge District. There are two shafts: one 30, the other 60 ft. deep. The vein is narrow, averaging 10 in. wide. J. Hitchcock, of Oakland, Alameda County, owner.

Morrow Mine (Quartz).—See Bazinet Mine.

Mountain Lily Mine (Quartz).—It is in T. 7 S., R. 21 E. Open cuts show a vein 2½ ft. wide. D. L. McClellan and C. Melvin, of Coarse Gold, owners.

Mountain View Mine (Quartz).—This mine is situated in Sec. 6, T. 9 S., R. 21 E., and has three shafts, varying from 50 to 100 ft. in depth, and drifts from the bottom of the shafts, the longest of which is 290 ft. The ore is gold-bearing quartz, some of which is heavily sulphuretted. The width of the vein varies from 2 to 6 ft. The walls are granitic. See our Xth Report, p. 198. This mine was reopened in May, 1894, 14 men being employed. J. Donahoe et al., of Fresno, owners.

Mud Springs (*Wilson*) *Mine* (Quartz).—This claim is in Sec. 26, T. 9 S., R. 21 E. The workings consist of an incline 300 ft. deep. The vein has an average width of about 16 in. S. H. Wilson, of O'Neals, owner.

Muhly Mine (Placer).—It is on the North Fork of the San Joaquin. T. Muhly, of North Fork, owner.

Nellie Gray Mine (Quartz).—It is in Sec. 14, T. 9 S., R. 21 E. The vein is only a few inches in thickness, but the ore is very rich. The walls are granitic. J. H. Oester, of O'Neals, owner.

Never Sweat Mine (Placer).—It is in Sec. 1, T. 10 S., R. 21 E. J. A. Harris, of Pollasky, Fresno County, owner.

New Citizen Mine (Quartz).—It is in Deadwood Gulch, Potter Ridge District. It is opened by a 100 ft. shaft and a 180 ft. tunnel, the vein showing a width of about 5 ft. About a mile from the mine there is a stamp mill and two concentrators. C. A. Lea et al., of Plainsville, New Jersey, owners.

North Lillie Mine (Quartz).—An extension of the Lillie, in Hildreth District. F. Wetmore, of O'Neals, Fresno County, owner.

Overlooked Mine (Placer).—It is in Sec. 31, T. 9 S., R. 22 E. J. H. Morris, of Hildreth, owner.

Owl Mine (Quartz).—The mine is on Jackass Mountain. There is a tunnel about 400 ft. in length, and stopes from same. The vein shows a width of from a few inches to 2 ft., dipping 50° N.W. The clean quartz carries iron sulphurets and a little galena. See the Waterloo Gold Mining Company in our XIth Report, p. 216. G. D. Hitchcock, of Madera, owner.

Paymaster Mine (Quartz).—This claim is in Sec. 15, T. 8 S., R. 21 E. The tunnel is over 900 ft. long, but partly caved in; there is an 80 ft.

shaft. The vein is said to be from 1 to 20 ft. in width, showing sulphurets. There is a 10-stamp mill on this claim. Waterloo Gold Mining Company, of San Francisco, owners.

Paterson Mine (Quartz).—This is a westerly extension of the Mud Springs Mine, in the Hildreth District. There are two shafts, one 140 ft. deep, the other 90 ft. J. Keating, of O'Neals, owner.

Pine Grove Mine (Quartz).—This mine is about 7 miles E. of the North Fork of the San Joaquin River. The workings consist of a 130 ft. tunnel, partly caved in, and several open cuts. The ledge in the tunnel shows a width of about 2 ft. In the open cuts the lead pitches N.E., but in the tunnel the vein has a S.E. pitch; the angle of inclination, both in the cuts and in the tunnel, is less than 25°. The ore is decomposed quartz and clayey matter; it is worked in an arrastra operated by water power. The walls are disintegrated granitic rock. Jas. Lawson, of North Fork, owner.

Plain View Mine (Quartz).—This claim is in Coarse Gold Gulch. Potter Ridge District. In the 8 ft. shaft and an open cut, the vein is 18 in. wide. F. Mello and J. Elam, of Coarse Gold, owners.

Pray Mine (Quartz).—It is in Fine Gold Gulch, Hildreth District. There is an open cut about 12 ft. deep. The vein, showing free gold, is about 6 in. wide and dips 60° N. It is a free-milling ore. The walls are granitic. D. L. Pray et al., of O'Neals, owners.

Prospect Mine (Quartz).—This claim is in Swede Gulch, Potter Ridge District. The vein is 18 in. wide. Chris. Petersen and Theo. Jones, of Coarse Gold, owners.

Prospect Mine (Placer).—This is in Sec. 35, T. 9 S., R. 21 E. Chris. Petersen et al., of Hildreth, owners.

Providence Mine (Quartz).—The claim is in Deadwood Gulch, Potter Ridge District. One of the owners states that the developments consist of a tunnel more than 800 ft. in length, and that the ledge is 20 ft. between the walls. D. McClellan and Chas. Melvin, of Coarse Gold, owners.

Quartz Mountain (*Mine d'Or de Quartz Mountain*) *Mine* (Quartz).—This mine is situated in T. 8 S., R. 21 E. There is a 60-stamp mill and hoisting works on the property. See our VIIIth Report, p. 210. J. Dunn, of San Francisco, owner.

Riffle Mine (Placer).—It is in Sec. 26, T. 9 S., R. 22 E. W. W. Poole, of Hildreth, owner.

Riverside and Starlight Claims (Quartz).—These are S.E. of Indian Peak Mine, and half a mile E. of Grub Gulch. Considerable work has been done at the joining line of these claims. Six veins 1 to 4 ft. wide, striking into the contact, have been exposed in cuts and small shafts. One tunnel is run some distance into the mountain on the contact; a winze sunk in the tunnel is in the ore. Some of this quartz yields in the mill from $40 to $200 per ton. The hanging-wall is the "Indian Peak" slates; the foot-wall, mica schist. The main vein at contact is 4 ft. wide; it dips with the hanging-wall slates. Southerly from this point are two claims on which no work was done. Chas. Ward, of Grub Gulch, owner.

Round Tree Mine (Quartz).—This mine is in Sec. 6, T. 10 S., R. 22 E. The workings consist of a 30 ft. incline. The vein is about 8 in. wide. E. D. Topping, of Hildreth, owner.

Runaway Mine (Quartz).—This mine is in Sec. 30, T. 9 S., R. 22 E. Developments consist of a 100 ft. incline. The vein is from 2 to 4 in. in width. The walls are granitic. R. Williams, of Hildreth, owner.

San Joaquin Mine (Quartz).—The claim is in Sec. 26, T. 10 S., R. 21 E. The workings consist of an upper tunnel about 40 ft. long, and a lower tunnel, which is about 50 ft. long; a winze has been sunk to a depth of 30 ft. in the latter tunnel. The vein is about 18 in. wide and dips about 70° N.W. J. A. Harris et al., of Pollasky, Fresno County, owners.

San Joaquin Mine (Quartz). This mine is in Sec. 7, T. 10 N., R. 22 E. There are three tunnels; the lower is 480 ft. long. An upraise connects the middle and the upper tunnel. The ledge varies from 6 in. to 2 ft. in width, and dips 50° N.W. Geo. Sym, of Hildreth, owner.

Savannah (Atlanta) Mine (Quartz).—This is the first claim on the Mammoth lode south of the Fresno River, and is 1½ miles S.E. of Grub Gulch. The vein is 4 to 6 ft. wide, and lies entirely within the "Indian Peak" slates. The contact is here obscure. The vein dips 50° N.E. The dike of granulite in this claim cuts through the main shaft, displacing the vein. At the northern end of the claim the dike is 100 ft. distant in the hanging-wall, and is nearly vertical. The vein does not appear to have faulted, being simply displaced by the dike. The quartz at the bottom of the 100 ft. shaft showed a distinctly banded structure, greatly resembling the cleavage of the inclosing slate. It is highly probable that this vein represents a silicification of the slates along the zone of fracture, the silicates of alumina and magnesia being replaced by quartz, iron sulphurets, and gold. The vein quartz often shows a quantity of chloritic matter, altered from the biotite mica of the slates. The quartz is granular and vitreous, but frequently shows gold. A 10-stamp mill was in course of construction in May, 1893. J. E. Spencer, of Grub Gulch, owner.

S. E. Canady Mine (Quartz).—This is a southeastern extension of the Canady Mine. There is an open cut about 40 ft. in length and 5 ft. deep. The vein, showing sulphurets, is about 8 in. in width, and dips 45° W. S. E. Canady & Bro., of Pollasky, Fresno County, owners.

Seneca Mine (Placer).—This claim is in Sec. 25, T. 10 S., R. 21 E. Seymore May, of Pollasky, Fresno County, owner.

Sequin Mine (Quartz).—This prospect is in Potter Ridge District. In the 12 ft. shafts and open cuts, the vein is 1 ft. wide. D. McClellan and Chas. Melvin, of Coarse Gold, owners.

Smultz Mine (Quartz).—In Hildreth District. There is a tunnel about 80 ft. in length and a shaft 40 ft. deep. The vein averages about 1 ft. in width, and dips 40° N.W. Smultz Bros., of Fresno, Fresno County, owners.

Snow Flake Mine (Quartz).—This is a southwestern extension of the Baltimore. It is opened by a 375 ft. tunnel. The vein shows a width of from a few inches to about 2 ft. The vein dips 60° N.W. The ore is mixed with clayey matter, the harder portions showing sulphide of iron and a little galena. Smith Norris, of Fresno, owner.

Standard Mine (Quartz).—The claim is in Sec. 14, T. 9 S., R. 21 E. Developments consist of a 135 ft. incline, a 25 ft. drift, and a tunnel 35 ft. in length. The width of the vein varies from a few inches to 4 ft. The vein, which shows some sulphurets, dips 30° S. T. S. Baker and G. W. Keller, of O'Neals, owners.

Standard No. 2 Mine (Quartz).—An extension of the Lingo Mine. The developments consist of a 60 ft. tunnel and open cuts. The vein, showing free gold, averages about 16 in. in width. D. McClellan and Chas. Melvin, of Coarse Gold, owners.

Starbuck Mine (Quartz).—This is in Fine Gold Gulch, Hildreth District. It is opened by a tunnel 40 ft. long and several open cuts. The vein is 6 in. wide and dips 30° N.E. The walls are granitic. Mark Anderson, of O'Neals, owner.

Stemwinder Mine (Quartz).—This claim is on Jackass Mountain. The tunnel is about 35 ft. in length and the shaft 20 ft. deep. The vein is about 18 in. wide and dips 20° W. Smith Norris, of Fresno, owner.

Sunol Mine (Quartz).—It is in Sec. 36, T. 7 S., R. 20 E., in Potter Ridge District. The shaft is 100 ft. deep and the ledge 2 ft. wide, dipping 45° E. The *Antonia*, *Headlight*, and *Meta* are extensions, and are owned by J. Krohn, of Coarse Gold.

Surprise (Old Jackass Brown) Mine (Quartz).—It is on Jackass Mountain. There is a shaft 40 ft. deep, a tunnel 100 ft. long, and open cuts. The vein shows a width of a few inches, and dips 60° S.E. B. Norris, of North Fork, owner.

Swede Gulch Mine (Quartz).—This mine is in Swede Gulch, Potter Ridge District. The shafts are 20 ft. and 14 ft. deep. The vein shows a width of from 2½ to 3 ft. F. A. Cornell, of San Francisco, owner.

Telles & Morton Mine (Placer).—The claim is in Sec. 12, T. 8 S., R. 22 E. The claim is leased to a Chinese company. J. M. Telles and J. R. Morton, of North Fork, owners.

Texas Flat Mine (Quartz).—This is in Secs. 7 and 8, T. 8 S., R. 21 E. See our VIIIth Report, p. 212. J. B. Haggin et al., owners.

Tiger Mine (Quartz).—It is half a mile S. of Grub Gulch. It is a small fissure vein, striking nearly E. and W. and dipping N. It varies from a small crevice to 3 ft. in width. A large dike of felsitic rock is always associated with the vein, though not always in contact with it. The vein contains large amounts of coarsely crystalline dolomite, and occasionally a green scaly mineral, similar in appearance to mariposite. The quartz is massive, and contains gold and silver, and sulphurets of iron, lead, and zinc. W. A. Poole, of Grub Gulch, owner.

Triangle Mine (Placer).—In Sec. 26, T. 9 S., R. 21 E. J. D. Jones, of North Fork, owner.

Unmitigated Mine (Quartz).—This adjoins the Columbus on the north. The shaft is 50 ft. deep. The vein varies from 8 to 14 in. in width. J. Morrison and F. C. Nimes, of Coarse Gold, owners.

Viana Mine (Quartz).—In the Hildreth Mining District. There is a 400 ft. tunnel on the property. W. R. Hampton, of Pollasky, Fresno County, owner.

Vienna Mine (Quartz).—In Potter Ridge District. The work consists of open cuts. F. Dutchman et al., of Coarse Gold, owners.

Volcano No. 1 Mine (Quartz).—This is at Hildreth, in Sec. 26, T. 19 S., R. 21 E. There is a 130 ft. incline, with drifts from same. The vein shows about 12 in. and dips N.W. A new tunnel has struck the vein at a lower elevation than that of the old workings. The quartz shows a few sulphurets, and prospects well in the horn. W. Beck and Chas. O'Neal, of O'Neals, owners.

Washington Mine (Quartz).—This is in Deadwood Gulch, Potter Ridge District. It is opened by cuts, from which a large amount of decom-

posed quartz has been "sluiced out"; also by a 20 ft. shaft. The vein is about 2 ft. wide, and shows free gold. D. McClellan et al., of Coarse Gold, owners.

Willow Creek Mine (Quartz).—This claim is in Sec. 21, T. 9 S., R. 21 E. Developments consist of shafts and open cuts, which in May, 1894, were partially filled with water. The vein is claimed to be 4 ft. wide; the walls are granitic. Charles O'Neal, of O'Neals, owner.

Wilson Mine (Quartz).—See Mud Springs.

Zebra Mine (Quartz).—It is in Fresno District. Developments consist of tunnels and shafts, in all about 1,000 ft. of excavations. The vein shows a width of from 10 in. to 2 ft.; the walls are granitic. See our VIth, VIIIth, and Xth Reports, pp. 210 and 199. Zebra Mining Company, owners.

GEOLOGY OF A PORTION OF MADERA AND MARIPOSA COUNTIES.

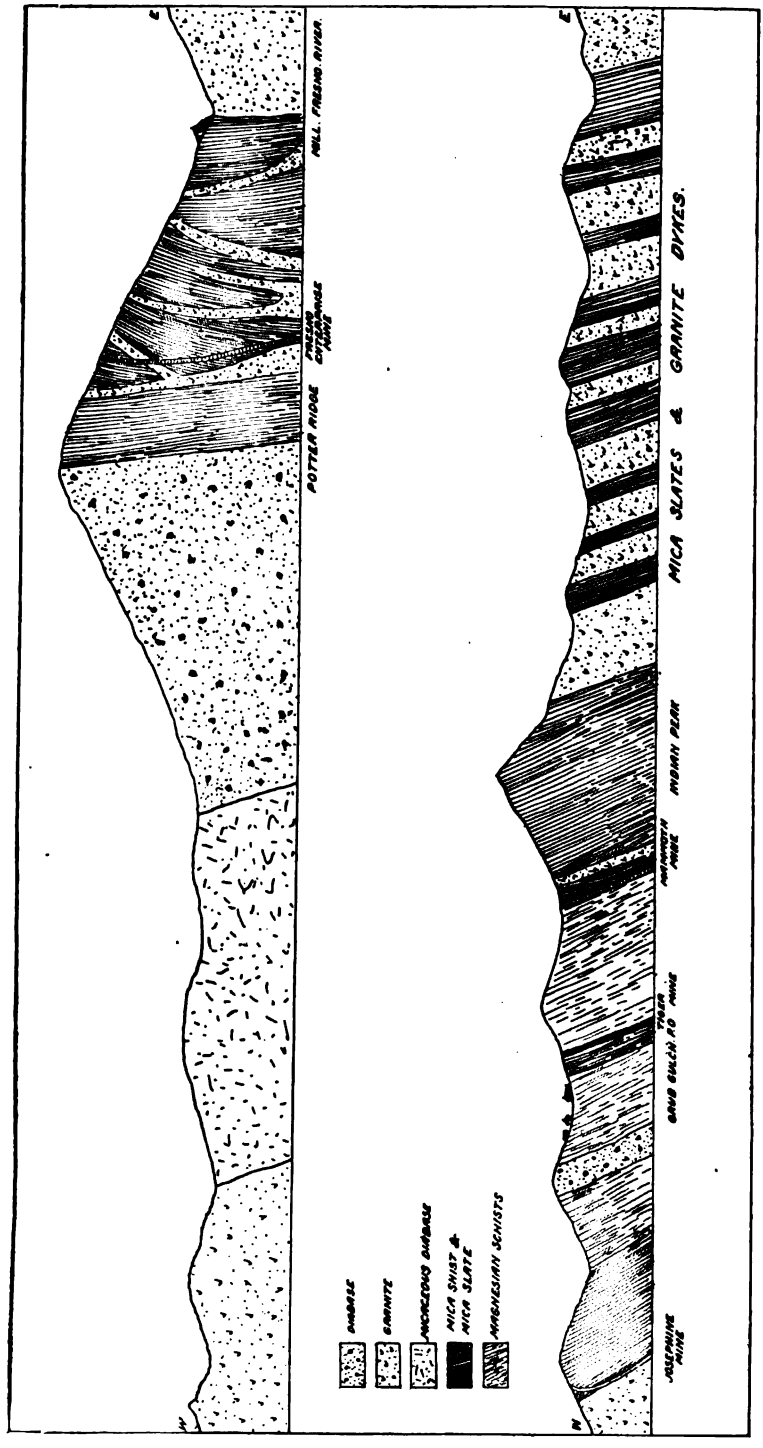
By W. H. Storms.

The geology of the region lying a few miles on either side of the Madera-Mariposa county line is unusually interesting, as in this section the great "Mother Lode" finds its southern termination and a new series of mineral zones takes its place southward.

The broad belt of slates and schists, commonly called the "auriferous slates," which flank the western slope of the Sierra for more than 200 miles, in Mariposa County split up into comparatively narrow arms, which extend southeastward far into the granite, the great masses of which replace the massive intrusions of diabase and diorite which occur northward.

All along the granite contact the slates and schists are found greatly disturbed, indurated, and contorted into folds, with greatly varying strike and dip.

There are five distinct belts of slaty and schistose rocks reaching southeast into the granitic area. On the west is that from the vicinity of Hornitos through the Buchanan copper district toward Hildrethville and beyond. This belt varies from 12 miles at the north end to 3 or 4 miles at the south. Its western boundary, as far as exposed, is the Quaternary deposit of the San Joaquin plain. Eastward a granite zone 8 to 12 miles wide separates this west slate belt from that which reaches from 4 miles southeast of the town of Mariposa through to Grub Gulch, in Madera County, and south into Fresno County. The eastern border of this second slate area is greatly disturbed, the slates and schists being interstratified with broad and narrow dikes of granite, diabase, and other eruptive rocks. These granite dikes unite on the north, and the granite sends an arm several miles to the north reaching to Mount Bullion. Still farther east a third zone of schists extends from Buckingham Mountain, in Mariposa County, through Potter Ridge, in Madera County, into Fresno County. This belt is not more than a mile in width. Eastward again is found granite in a narrow belt; it is highly metamorphic, commonly showing a gneissoid and sometimes a porphyritic structure. East of this lies the belt of black slates, schists, and limestone of the Hite's Cove region. A large lens-like mass of granite has been thrust into these rocks on the north side of the Middle Fork of the Merced River. It is about 1 mile in length and half a mile



GEOLOGICAL CROSS-SECTION 18,000 feet from JOSEPHINE MINE GRUB GULCH P.O. East to FRESNO RIVER at ENTERPRISE MILL. MADERA CO. CAL.

wide. It appears to be entirely surrounded by the schists. The Hite's Cove metamorphics extend several miles to the southeast through the Silver Peak region and beyond. East of these is a succession of granitic and highly metamorphic areas, which include many broad masses of diorite, which have their neucleal mass in Mount Raymond.

The details of this complex geological field would be best illustrated by a map showing these formations.

The "Mother Lode" ends in the southern part of Mariposa County, a description of the detailed geology of which will be found in our Xth Report, p. 25. Each of the arms of slaty and schistose rocks, which extend south includes a series of mineral veins having well-defined characteristics, and differing in every particular from the veins of the "Mother Lode."

The veins appear to have been formed subsequent to the intrusion of the granite. Dikes of granitic type, viz., felsite, felstone, granulite, aplite, and pegmatite granite, commonly accompany the veins of this region, and in some cases may be traced directly to the large granitic masses of the neighborhood. It is not improbable that the intrusive mountain masses and smaller dikes of diorite and diabase are also subsequent to the eruption of the granite.

It is generally supposed, and has frequently been asserted, that the metamorphic rocks of the auriferous series represent an unbroken formation; that the cleavage planes and sedimentary planes are identical. The occurrence of conglomerate rocks would suggest unconformability, though none has ever been observed

At the old townsite of Carson, in Mariposa County, are acres of slaty tailings of the early placer mining. Everywhere may be found slates with fine cleavage, on the smooth faces of which may be seen what are undoubtedly lines of sedimentation. These lines cross at nearly 90°; southward, however, this angle is somewhat less. This would indicate that Carson is about the axis of the fold.

MARIPOSA COUNTY.

Though the mineral resources of this county, chiefly gold, are large, this industry is not in a flourishing condition, owing to the fact that the greater portion of the mining territory is covered by two vast private properties, viz.: The Mariposa, or Fremont Grant, and the Seth Cook estate, and that still another large tract embracing mineral land—the Yosemite Park—retards mining operations. Within the past two years, however, the Mariposa estate mines have been investigated by the owners with a view of resuming operations, and negotiations for the transfer of the Cook estate are said to be pending. The indications now are that "old Mariposa" is on the eve of a mining boom.

Barley Field Mine (Quartz).—It is 4½ miles N.E. of Mariposa, near the Champion. The vein occurs in granite.

Bandarita Mine (Quartz).—It is 12 miles E. of Coulterville, on the North Fork of Merced River, and is on the "East Lode." Geologically it is similar to the Hite Mine. C. L. Mast, of Coulterville, Superintendent.

Bondurant Mine (Quartz).—It is on the "East Lode," 11 miles N.E. of Coulterville. See our Xth Report, p. 345. Idle. Bondurant Gold Mining Company, of St. Louis, Missouri, owners.

Black Bart Mine (Quartz).—It is situated on a spur of the Buckthorn Mountain, 11 miles E. of Coulterville. The fissure strikes E. and W., dipping 25° N. It occurs in splintered diabase, and is accompanied by a light-colored, granular dike rock. The quartz varies from a seam to 3 ft. in width. It is often found interstratified with the dike. The miners find, by experience, that the softening of the dike, together with the appearance of much iron and scales of chloritic mineral, are indications of the proximity of a "pocket" of gold. There are several claims on this vein, but this was the only one working in 1893. S. B. Sample, of Coulterville, owner.

Campodonica Mine (Quartz).—It is 1 mile E. of Hornitos. Campodonica Mining Company, of Hornitos, owners.

Champion Mine (Quartz).—Described in our Xth Report, p. 303. Jas. Ridgeway, of Mariposa, owner.

Cherokee Mine (Quartz).—This claim is 9 miles E. of Coulterville, and contains two parallel veins, 30 ft. apart. Jas. Shimer, of Coulterville, owner.

Congo Mine (Quartz).—It is 4 miles E. of Coulterville. A cross-cut tunnel 300 ft. in length has cut the vein 200 ft. from the surface. The vein is in slate, near diabase, and strikes N.W., dipping 50° N.E. John Metzer & Co., of Coulterville, owners.

Coulterville District.—Two great veins branch out in the Pine Tree and Josephine mines and extend northwestward to and beyond Coulterville. These veins are locally known as the Pine Tree or "Mother Lode," and the Josephine or "West Lode." See our Xth Report, p. 35. The principal claims on the "Mother Lode" between the Pine Tree Mine and Coulterville are the Daliah, Louisa, Mary Harrison, and Virginia. On the "West Lode" are the Tyro, Malvina No. 1 and No. 2, and the Potosi.

Cranberry Mine (Quartz).—It is on the North Fork of Merced River, 4 miles N. of Hite's Cove. See our VIIIth Report, p. 348.

Daliah Mine (Quartz).—It is on the "Mother Lode," 2½ miles S.E. of Coulterville. See our VIIIth and Xth Reports, pp. 346 and 41. General Boyd, of San Francisco, owner.

"*East Lode.*"—About 16 miles east of the "Mother Lode," and extending for a distance of 80 miles N.W. from Hite's Cove, is a gold-bearing belt or lode system of great importance (having produced about $10,000,000), locally known as the "East Lode." The principal mines in this belt are the Ferguson, Hite, and Kanaka mines, in Mariposa County; Buchanan, Dead Horse, Eureka, Keltz, and Soulsby in Tuolumne County; Sheep Ranch, in Calaveras County, and Clinton Mine, near Pine Grove, in Amador County. These mines, and many others, occur in a zone a mile or more in width. The southern end is entirely in slate and the northern portion entirely in granite. The veins have a greatly varying strike and dip; the general trend of the veins, however, is to the W. of N., and the dip to the E. In some parts of the lode the fissure is represented by one main crevice with many branches, while in other portions there are two or three separate fissure systems, as in the North Fork of Tuolumne River, between the Buchanan and Eureka mines. The lode is distinguished by the branching character of the fissures, the inclusion of slaty material in the quartz, and usually by a banded structure of the veins. These mines have nearly all been described in former reports of the State Mineralogist, particu-

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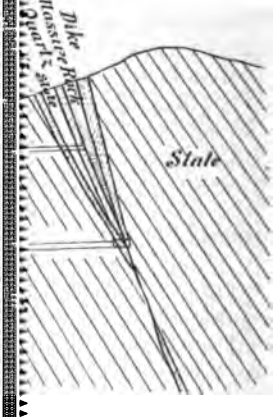

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Going eastward from the main workings a long drift has been run, which frequently shows the vein to split and send off shoots or crevices into the hanging-wall side; indeed, it is sometimes difficult to say which is the main fissure. The quartz commonly includes more or less slaty material, and in places exhibits a banded structure, and rock of this character was uniformly good. These appear to be the chief characteristics of the Hite Mine, and they are common to most of the mines of the "East Lode," and in fact to most mines in the slate rocks elsewhere.

The developments were described in our VIIIth Report, p. 344. For some distance down the incline winze, the vein continued large and massive; lower it stratified and was lost, only the fissure filled with crushed black slate remaining. A drift was run eastward on this crevice at the bottom of the winze, 900 ft. from the surface. Some distance from the station a cross-cut into the hanging-wall disclosed 14 ft. of solid quartz and no wall. This rock was very low grade, but it was also a long way east of the pay shoot which had been followed down from the surface and which pinches westward, its lower limb passing just below the station level at the top of the winze.

It has been shown in a number of instances in mines in the slate rocks of Amador County that the disappearance of pay quartz at any point between the surface and 1,000 ft. does not prove that the lower levels are destitute of pay rock. This fact is particularly exemplified in the Kennedy and Hardenburgh mines, in Amador County. John Hite, of San Francisco, owner.

Hornitos District lies in that belt of crystalline schists which extends from the plains of the San Joaquin into the first low-lying foothills, in the western part of Mariposa County. The mining industry, once prominent, is now almost at a standstill, only one mine being in operation.

Josephine Mine (Quartz).—It is on the Mariposa estate. See Pine Tree and Josephine. Mariposa Estate, owner.

Juniper Mine (Quartz).—This is 1½ miles W. of Bear Valley. It occurs at a contact of slate and diabase on the surface, but in depth the fissure passes into the slates. The quartz is hard and massive, and carries sulphides of iron, lead, and zinc. A dike of felsitic rock accompanies the vein.

Kanaka Mine (Quartz).—It is 7 miles E. of Groveland. It is equipped with a 10-stamp mill. In operation in 1893. Louis Casretto, of Groveland, owner.

Lacy (Talc) Mine (Pocket).—It is 7 miles N.E. of Mariposa. See Xth Report, p. 304. Working in 1893. Geo. Lacy, of Mariposa, owner.

Louisa Mine (Quartz).—This is on the east side of Maxwell Creek, just below the town of Coulterville. It appears to present all those features which characterize this portion of the "Mother Lode" as far north as Carson Hill, in Calaveras County. Where the lode crosses the creek it has a width of 300 ft. The lode consists of a great mass of ankerite and mariposite, including a reticulated mass of quartz veins, large and small. On the east or hanging-wall side of the lode is massive diabase, and on the foot-wall side a dike of diabase separating it from a belt of black slate a mile or more in width. On the east bank of Maxwell Creek is exposed a mass of quartz, 19 ft. wide, 25 ft high, and 300 ft. long. It does not appear on the surface on the opposite side of the creek. A shaft sunk on the vein 60 ft. deep shows its thinning out at that depth; southward from this large mass a small vein branches

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OTHER LODE
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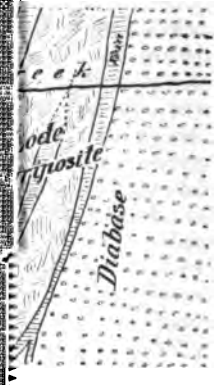

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In the greater portion of Calaveras County the veins occur entirely in the diabase; in the southern part of Amador County, at the contact of diabase and slate; and in the northern part of Amador County in the slate area, with small dikes similar to those of the southern part of Mariposa County. In this southern section no great mines are found at the contact of diabase and slate like those at Jackson, Sutter Creek, Amador City, and Drytown. A few "pocket veins" only occur at the "contact" in Mariposa. Gold-bearing veins occurring entirely within the diabase area in Mariposa County usually have a course nearly at right angles to the strike of the "Mother Lode."

Mariposa Mine (Quartz).—It is in Mariposa. Caved and inaccessible. Belongs to the Mariposa Estate.

Mary Harrison Mine (Quartz).—It is on the "Mother Lode," 2 miles S.E. of Coulterville. See our VIIIth and Xth Reports, pp. 346 and 41. Cook Estate, of Coulterville, owner.

Martin-Walling Mine (Quartz).—It is 8 miles E. of Coulterville. P. P. Mast, of Springfield, Ohio, owner.

McAlpine Mine (Quartz).—This is on the "Mother Lode" near the Tuolumne County line. See our Xth Report, p. 44. General Boyd, of San Francisco, owner.

Mexican Mine (Quartz).—It is 1 mile S.W. of Bear Valley P. O., on the Mariposa estate. Mariposa Estate, owner.

Mexican's Mine (Quartz).—It is 1½ miles W. of Bear Valley P. O., and is the west extension of the Sirocco. It was being worked in a small way in 1893.

Missouri Gulch Mine (Quartz).—It is 1 mile N.E. of Mariposa, on the Mariposa estate. (See Evans Mine.) Mariposa Estate, owner.

Mount Ophir Mine (Quartz).—It is on the "Mother Lode," 1 mile N. of Princeton, and belongs to Mariposa Estate. See our Xth Report, pp. 26 and 33.

Nevada Mine (Quartz).—This is one of a system of fissures in the diabase of the east slope of Bear Valley Mountain, not far from the summit, and half a mile south of the Bear Valley and Hornitos road. In character the vein resembles that of the Sirocco. It occurs in slaty diabase, much split up, the quartz inclosing masses of the country rock, usually altered to chloritic schist. On these portions of the vein the gold occurs in "pockets," ranging from a few dollars to more than $500. Hall & McFadden, of Bear Valley, owners.

No. 9 Mine (Quartz).—This is 2½ miles E. of Hornitos. It was worked to a depth of 400 ft., but is now idle. The hanging-wall is mica schist, the foot-wall a felsitic dike. There are still large quantities of low-grade quartz in sight. E. P. Casterline, of Hornitos, owner.

Oso Mine (Quartz).—It is on the Mariposa estate, half a mile W. of Bear Valley P. O. Mariposa Estate, owner.

Peregory & Heiser Mine (Quartz).—It is 5½ miles N. of Mariposa. See our Xth Report, p. 308. Idle.

Pine Tree and Josephine Mines (Quartz).—These are at present the only largely developed and accessible properties on the Mariposa estate, and though previously referred to in our Xth Report, p. 35, they appear to merit more particular description.

Within the limits of these claims the great "Mother Lode" forks, one branch—the Josephine, or "West Lode"—striking to the northwestward, the Pine Tree, or "Mother Lode," having a somewhat more north-

ked characteristics through
Hill, in Calaveras County,
yond which it splits up,
kes on a new aspect, and
ntinues under different
nditions.

The Pine Tree vein is char-
terized by its massiveness
d the entire absence of slaty
aterial. Where exposed in
e workings it occurs at a
ntact of the ankerite and a
uch altered massive rock,
hich lies to the east of it,
e character of which has
ever been satisfactorily de-
rmined. At its point of con-
rgence with the Josephine
in both are included within
e ankerite. Northward the
anging-wall of the Pine
ree vein becomes a light-
ray, coarsely granular rock,
nd still farther northward
is serpentine.

The Josephine, like the
ine Tree vein, has the an-
erite on either side, but
act of ankerite and black
, wedge-like mass of gray
ankerite, while the foot-wall
hist continues is not known,
ne vein lies entirely within

hine vein is usually more
characterized by the inclu-
l, and often by a banded
ore than 50 ft. in width.
m 48 to 51 ft. in width for a
is believed, pitches north-
is not always well defined,
more slaty, the slate finally
t of the shoot is determined
. As a rule, the slaty foot-
ve quartz on the hanging-

t arsenate) in the Josephine
he United States Geological
orescence (cobalt bloom) of
in the field of the Mining
phine toward the Pine Tree
h the *erythrite* occurs (a talc

hist) resulted in the discovery that it contained the rare mineral maite (*cobaltic mispickel*), a cobalt-bearing arsenical pyrite.

Piñon Blanco Mines.—See our Xth Report, p. 43.

Pocket Lode.—Is 7 miles E. of Mariposa, in a small mining camp alled Mono, which is the southern limit (as far as known) of a granitic ike which extends in a southeasterly direction 15 miles from Buck- horn Mountain. In texture this dike ranges from felstone and granu- te at the southern end and in its smaller branches, to a coarse-grained, mica-bearing granite of rather coarse texture northward, where it is 60 o 100 ft. wide. Its characteristics are described in our Xth Report nder the caption "The Talc Mines," p. 304. Northward this belt is alled the "Porphyry Mines."

Porphyry Mines.—See Pocket Lode.

Potosi Mine (Quartz).—It is on the "West Lode," 2 miles W. of Coulter- ville, adjoining the Malvina. See our VIIIth and Xth Reports, pp. 347 and 39. Cook Estate, of Coulterville, owner.

Princeton Mine (Quartz).—It is at Princeton, and belongs to the Mari- posa Estate. Has been very productive, but suspended work at the 400 ft. level. In character it resembles some of the Amador County mines, near Plymouth.

Quail Mine (Quartz).—It is 10 miles E. of Coulterville. Provided with a mill and is worked when there is water in the gulches. F. Bruschi, of Coulterville, owner.

Quartz Mountain Mine (Quartz).—This is 2 miles S. of Hornitos. The vein strikes N. 30° E., dipping 28° S.E. The erosion of the hanging-wall from the upper portion of the vein has left a large exposure of quartz. The hanging-wall is chloritic schist; the foot-wall diorite schist. The main incline has reached a depth of 200 ft.; levels were run 150 and 200 ft. from the surface, and a stope opened between them. A 10-stamp prospecting mill is on the mine and is run week days only. The sulphurets are concentrated on two Frue vanners. M. L. Rogers, of Hornitos, owner.

Red Cloud Mine (Quartz).—It is in the slate area 10 miles N.E. of Coul- terville. See our VIIIth Report, p. 345. Geologically it is very simi- lar to the Hite Mine. In operation in 1893. Red Cloud Mining and Milling Company, of Boston, owners.

Red Hill Mine (Quartz).—It is near the "Mother Lode," 4 miles S.E. of Coulterville. It occurs on the contact of serpentine and diabase. The ore is gold-bearing copper sulphurets. See our Xth Report, p. 41. G. Commissiona, of Coulterville, owner.

Sebastopol Mine (Quartz).—It is 4 miles S.E. of Mariposa, on the Hart ranch. See our Xth Report, p. 305. The vein is accompanied by a dike of aplite (a granite without mica). This mineral belt, with its granitic dikes, extends southeasterly into Madera and Fresno counties. — Hart, of Mariposa, owner.

Sherlock Mine (Quartz).—It is 5½ miles N. of Mariposa. See our Xth Report, p. 306.

Sirocco Mine (Quartz).—This is 1½ miles W. of Bear Valley P. O., just outside the limits of the Mariposa estate. The vein is a fissure, striking E. and W. in diabase, which along the fissure is altered to chloritic schist. The gold is found in quartz, which occurs somewhat irregularly, including many lens-shaped bunches of the country rock. Some of the schist is also rich in gold. The property is equipped with a

steam hoist. Work was resumed in July, 1893, after a period of idleness. Burt & Bach, of Bear Valley P. O., owners.

Star Mine (Quartz).—It is 12 miles E. of Coulterville. P. P. Mast, of Springfield, Ohio, owner.

Talc Mines.—See Pocket Lode.

Tyro Mine (Quartz).—It is on the "West Lode," 1½ miles S. of Coulterville. It is equipped with a steam hoist and a 10-stamp mill, all under one roof. In July, 1893, the shaft had reached a depth of 420 ft. The vein varies from 4 to 7 ft. in thickness. The quartz contains about 3 per cent of sulphurets. For geological description, see our Xth Report, p. 39. Tyro Mining Company, owners; Thos. Haven, Secretary, 110 Montgomery Street, San Francisco.

Vanderbilt Mine (Quartz).—This property is on the southern end of Buckingham Mountain, 8 miles E. of Mariposa, and in the mica schists, having granite both E. and W. of it. This belt extends southeastward to Potter Ridge, in Madera County. The Vanderbilt Mine comprises a number of large bunches and vein-like masses of glassy quartz associated with granitic dikes, one of which contains gold. Considerable work has been done on the property, but it was idle in 1893. The hanging-wall is granulite and the foot-wall mica slate, which, near the contact with the granitic dike, has developed crystals of feldspar of considerable size. Judge Condon, of Mariposa, Superintendent.

Virginia (Coe) Mine (Quartz).—It is on the "Mother Lode," 4 miles S.E. of Coulterville. See our Xth Report, p. 41. Virginia Mining Company, of Springfield, Ohio, owners; J. S. Crowell, Secretary.

Washington Mine (Quartz).—It is 2½ miles N.E. of Hornitos. Formerly a large producer, but is now idle. It is 1,500 ft. deep; strikes N. 40° W., and dips 70° S.E. The vein, 6 to 12 ft. wide, is inclosed in mica and hornblendic schists. A dike rock of light color and felsitic texture accompanies the vein, occurring on the foot-wall side of the vein at the north end and on the hanging-wall side at the south end. Considerable masses of rock resembling the ankerite and mariposite of the "Mother Lode" occur in the Washington Mine. M. L. Rogers, of Hornitos, owner.

A further description of the geology of the region about Hornitos will be found in our Xth Report, p. 26. Large quantities of beautifully radiated pyrophyllite are found on a prominent butte 2½ miles from Indian Gulch P. O., and north of the road to Merced.

Whitlock Mine (Quartz).—It is 5 miles N. of Mariposa. The vein is from 4 to 10 ft. wide, and is developed by several hundred feet of tunnels and shafts. See our Xth Report, p. 33. Ward Bros., of Mariposa, owners.

Wilson Estate Mines (Quartz).—They are 1 mile E. of Hornitos. Miss Rose McCann, of Hornitos, owner.

MENDOCINO COUNTY.

The gold mining interests of this county are comparatively unimportant, very few mines being opened or worked.

Boy Edgar Mine (Quartz).—It is on top of the ridge and to the west of the trail from Ukiah to Lost Valley. There are five small openings made, and in every one a quartz vein is exposed. The largest one is 15 in. wide, strikes about N. of E., and stands nearly vertical. The

walls are micaceous slate. The quartz is said to assay $4 75 in gold. C. H. Staut, of Ukiah, owner.

Red Mountain Mining District lies on the western slope of the high ridge which divides the waters of Russian River from those of Clear Lake and Cache Creek, and extends from Doolan Cañon about 14 miles S. The country rock consists of serpentine and highly metamorphosed slates and sandstone. Gold in small quantities has been found in the gravel and debris of the lower foothills. Veins of gold-bearing quartz and of copper are found near the summits of the range, and several prospectors are at work on them.

Van Allen Mine (Quartz).—It lies on the slope of the high ridge of mountains west of Ukiah. The workings consist of an incline 20 ft. deep, and a tunnel, just started, farther down the hill. The ore consists of small stringers and irregular masses of quartz, showing sulphurets. The veins have a strike of 64° S. of E., and dip 45° N. The country rock is a tough, blue glaucophane schist. Wm. Van Allen, of Ukiah, owner.

MONO COUNTY.

The gold deposits of Mono County are found in a number of districts, the most important of which are Bodie, Jordan, and Homer districts. As a general thing most of the gold ores carry more or less silver. At Bodie they occur in hornblende andesite, and in Homer District in granite. Most of the work in the gold mines of this county is at present confined to Bodie and the region about Lundy. There are other sections where there are deposits of prospective value lying idle.

Basset Mine (Quartz).—This mine is situated in the old Mono Diggings, 12 miles W. of Bodie and half a mile S. of the Columbia Mine. The vein opened here runs N.E. and S.W. and has a thickness of about a foot. It dips S.E. at a low angle. The property is developed by three drifts, 90, 30, and 40 ft. long, respectively. H. T. Trewethan, of Lundy, owner.

Bay Queen Mine (Quartz).—It is situated near the summit of Mount Scowdan, 3 miles S.W. of Lundy. It is developed by a shaft 120 ft. deep. The vein stands very steep and is inclosed in granite. Finley Cameron, of Bodie, owner.

Bryant Mine (Quartz).—It is situated in the Homer Mining District, 3 miles S. of Lundy. The vein is a continuation to the S. of that on which the May Lundy and Lakeview are situated. It is developed by an incline 147 ft. deep, and by a drift from the bottom S. 180 ft. and N. 120 ft. A drift has also been run from the surface on the southern end of the claim. The character of the ore and position of the vein is very similar to that of the mines on the north. See our VIIIth Report, p. 371. H. B. Gleaves and H. P. Morrill, of Portland, Maine, owners.

Charleston Mines (Quartz).—This group of mines is situated on the north side of a small cañon a little south of Mill Creek, and immediately overlooking Mono Lake. Here are eight claims, of which the *Illinois* and *Charleston* are the only ones on which much work has been done. The Illinois is situated on a ledge running N.E. and S.W., with nearly vertical dip. It is developed by a shaft 50 ft. deep and by a tunnel 125 ft. long. The vein is somewhat bunchy, sometimes reaching a width of 5 ft., and is free milling. The Charleston lies at an elevation of 8,700 ft. It is developed by a tunnel and cross-cuts amounting to about 400

ft. A heavy body of quartz in a silicious slate was met a short distance within the tunnel. An excellently appointed 5-stamp mill, run by water power, has been erected below the Illinois claim. See our VIIIth Report, p. 385. J. P. Hammond, of Mono Lake P. O., owner.

Columbia Mine (Quartz).—It is in Mono Diggings, 12 miles W. of Bodie. The vein runs nearly N. and S., being inclosed in granite, and is generally very flat. The greatest width is about 10 in. It is developed by two tunnels, the lower 160 ft. and the upper 125 ft. long. From the upper one the vein has been stoped to the surface. The ore is free milling and rather high grade. T. Albright, of Lundy, owner.

Dark Horse Mine (Quartz).—This mine is situated on the western slope of the White Mountains, 10 miles N. of Bishop Creek. The ore body has the form of a bunch or kidney instead of a vein, and consists of sugary quartz, in places white, in others deeply stained with iron oxide. The property is opened by a shaft 110 ft. deep, and by tunnels and cross-cuts having a total length of about 700 ft. As shown by the workings, the ore body descends nearly vertically, but appears to become smaller. The inclosing rock is limestone. J. H. Bulpit, of Bishop Creek, owner.

Duarte Mine (Quartz).—It is situated 5 miles N.E. of Laws Station, and just above the Southern Belle. Here are two claims, on each of which there is found a small vein. The lower is opened by an incline 56 ft. deep and the upper by surface work. The ore in the latter is high grade. The inclosing formation is slate. — Duarte, of Laws P. O., owner.

Dunderberg Mine (Quartz).—This mine is situated in the Castle Peak District, 12 miles S. of Bridgeport. Here are seven claims on one vein running south from Green Creek, and dipping at a high angle to the west. The claim on which the developments have been made lies in the middle. A cross-cut tunnel 700 ft. long has been run from the east, cutting the vein. From this tunnel drifts run N. and S., the former being 200 and the latter 150 ft. long. From these drifts considerable stoping has been done. Except near the surface the gold is contained almost wholly in iron sulphurets. The vein varies from 2 to 8 ft. wide, the ore being rather high grade. This property has recently been placed under a working bond. A mill was operated here years ago, but much difficulty was found in saving the gold. A. F. Bryant, of Bridgeport, and G. K. and B. F. Porter, of San Francisco, owners.

Faulk Mine (Quartz).—This mine is situated in Lake Mining District, and joins the Mammoth on the north. It is developed by three tunnels, the lower and middle said to be 1,600 ft. long, and the upper 240 ft. These tunnels open a large vein of low-grade quartz from the north end of Mineral Hill. The vein dips about 70° E. near the surface, but in the deeper workings is said to dip west. The Mammoth Mine was worked chiefly through these tunnels. The vein is said to average 12 ft. in thickness, and with the exception of rich pockets of free gold the ore is mostly iron sulphurets. D. C. Albright, of Bishop Creek, owner.

Goleta Mine (Quartz).—It is on the eastern base of the Sierra Nevada Mountains, 6 miles N.E. of Lundy. It is one of a series of mines on an immense ore deposit running N. and S. This has not yet been opened sufficiently to show its pitch; the eastern wall is limestone, the western a porphyry-like rock. On the eastern side of this deposit is a vein of copper ore (malachite), 6 to 20 ft. in width, and averaging 8 per cent

of metallic copper. The copper carbonate impregnates an exceedingly crushed and decomposed rock. On the west is the gold and silver vein. This is much decomposed on the surface and in most of the workings, the quartz being honeycombed and in places almost replaced by the decomposed rock-mass and iron oxides. The quartz is evidently a replacement of the rock along the mineralized zone. The deposit is opened by two tunnels. The lower one is 1,190 ft. long and has not yet cut the ore body. The upper tunnel is 359 ft. above, and has a length of 360 ft. The copper vein has been drifted on N. 156 ft. and S. 182 ft. The upper tunnel runs through the quartz vein 67 ft. without striking the western wall. A drift has been run N. 40 ft. and S. 30 ft. From the south drift a winze has been sunk 56 ft. There are two cross-cuts on the vein from the north drift, 23 and 47 ft., without reaching the western wall. From the south drift two other cross-cuts have been run, respectively 38 and 49 ft. long. In places the decomposed ore is replaced by hard quartz, carrying iron sulphurets. The value of the ore is about equally distributed between gold and silver. On the same mine to the south and 400 ft. above, a shaft has been sunk 65 ft. on the vein. At this point the vein is 24 ft. wide. This is perhaps the largest ore deposit in the county, being traceable for over 7,000 ft. See our VIIIth Report, pp. 364 to 365. Goleta Mining Company, 330 Pine Street, San Francisco, owners.

Gorilla Mine (Quartz).—This mine is situated on the northern slope of Mount Scowdan and west of the Wolverine. The vein runs N. and S. and dips 80° W. The property is developed by two tunnels, from which a large amount of stoping has been done. The vein is supposed to be the same as that cut in the Erie tunnel. The ore was sent down the mountain by means of a tramway 2,700 ft. long. See our VIIIth Report, p. 370. Gorilla Mill and Mining Company, of San Francisco, owners.

Gray Eagle Mine (Quartz).—This mine lies 1 mile S.W. of Lundy, on the northern slope of Mount Scowdan. The quartz crops quite prominently nearly the whole length of the claim, ranging from a few inches to 3 ft. in thickness. The ore is honeycombed and shows some sulphurets. Considerable galena is present. Along the croppings the ledge is almost flat. F. Pierce, of Lundy, owner.

Harrison Mine (Quartz).—This mine is situated 1 mile S.W. of Lundy, on the northern slope of Mount Scowdan. The elevation is a little over 9,200 ft. The mine is the eastern one of a series located on a vein which has in general an E. and W. course and dips into the mountain at a low angle, 15° to 20° S. The vein reaches a thickness in places of 20 in. The ore is reported to carry nearly equal amounts of gold and silver in places, but the gold generally predominates. The silver is found in stringers and bunches of galena. The mine is opened by several short tunnels, from which some stoping has been done. A. L. Butterfield, of Lundy, owner.

Homer Mill and Mining Company (Quartz).—The property of this company, consisting of three patented claims, is situated on the northwestern slope of Mount Scowdan. The work done here consists of a tunnel 500 ft. long, run southerly on a bunchy vein. From the end of this tunnel one cross-cut runs W. 300 ft., and another E. 80 ft. The country rock is a dark feldspar porphyrite, in places heavily mineralized with iron sulphurets. No ore has been milled from this mine.

See our Xth Report, p. 342. Homer Mill and Mining Company, 330 Pine Street, San Francisco, owners.

Homestake Mine.—This property lies in Silverado Cañon, on the eastern slope of the Sweetwater range. The ore is very rich in places, carrying gold and silver in about equal amounts. But little work has been done here for some time. See our VIIIth Report, p. 360. Andy Sayers, of Bridgeport, owner.

Jackson and Lakeview Mining Company (Quartz).—The mines of this company are situated on the eastern slope of Mount Scowdan, at an elevation of nearly 11,000 ft. They include the *May Lundy*, *Lakeview*, and *Jackson*. The first two are located on an easterly series of veins, and the other to the west a little higher up the mountain. The May Lundy veins run N. and S. and dip at an angle of 30° to 74° W. At a vertical depth of 200 ft. the main vein has a pitch of 40°. There are three tunnels on the May Lundy Mine; the lower being 1,150, the next 600, and the upper 160 ft. long. Several winzes have been sunk below the lower tunnel, the deepest being 170 ft. On the incline of the vein this gives a depth of 750 ft. The east vein runs from 14 in. to 6 ft. in thickness. The ore is high grade. Occasionally a little galena, rich in gold, is found. In the bottom of the workings the amount of iron sulphurets has been found to increase greatly, and the free gold to decrease. The west vein on the May Lundy has not been worked. This vein is less than a foot in thickness, but rich. The *Lakeview* has been opened by a cross-cut tunnel cutting both veins. On the east vein a tunnel has been driven north connecting with the May Lundy. To the south a drift has been run 420 ft.; on the west vein drifts have been run N. 120 ft. and S. 56 ft. From this level a winze has been sunk, and the ore found to consist almost wholly of sulphurets. Above it was mostly free gold. The ore is conveyed 1,000 ft. to the mill by means of a wire tramway. See our VIIIth Report, p. 371. R. T. Pierce, of Lundy, Superintendent.

Johnnie and Rose of the West Mines (Quartz).—They are situated 16 miles S. of Benton. Here are found two veins running parallel and 600 ft. apart. The course is N. and S., and dip 45° W. The ore consists of free gold and sulphurets. The vein is said to average 1 ft. in thickness. John King, of Benton, owner.

Last Chance Mine (Quartz).—It is situated on the summit of Mount Scowdan, at an elevation of nearly 11,500 ft. Three veins are found here; two running N. and S. and dipping 70° E., and one running E. and W. and standing about vertical. The ore is free milling, and said to be high grade, particularly that of the E. and W. vein. The vein lying to the west is widest, being nearly 4 ft.; the others vary from a few inches up to 1½ ft. The veins are in granite and lie above the May Lundy series. The work done consists of three short tunnels. W. F. McKenzie, of Lundy, owner.

Lora Mine (Quartz).—It is in the Yellow Jacket Mining District, 10 miles S. of Benton. Here occurs an E. and W. vein, extending between the Neal and Tower mines. The ore carries lead, silver, and gold, and is said to be high grade. An incline shaft has reached a depth of 90 ft. The pay streak is from 4 to 6 in. wide.

Lucky Mortan Mine (Quartz).—This mine is situated nearly 3 miles S. of Lundy, and joins the May Lundy Mine on the north. Two winzes have been sunk, each 40 ft. Frank Todd, of Calais, Maine, owner.

Mabel Mine (Quartz).—It is situated on the western slope of the White Mountain range, 11 miles N. of Bishop Creek. On this claim are a number of deposits of irregular vein form, extending N.W. and S.E. in limestone. The ore consists of a friable sugary quartz, in places white, and in others deeply stained with iron oxides, which almost replace the quartz at times. The deposits outcrop prominently on both sides of Warm Spring Cañon, and are opened by tunnels and cross-cuts to the amount of about 400 ft. The ore is generally low grade, the deeply iron-stained portions generally being poorer than the lighter colored quartz. There are five claims in this group; three lying over the hill on the south side of the gulch, and containing silver and galena. The Excelsior claim has 400 ft. of tunnels and cross-cuts, though but little ore has been met. Owen Neylon, of Bishop Creek, owner.

Mammoth Mine (Quartz).—This mine, situated in Lake Mining District, was thoroughly described in our VIIIth and Xth Reports, pp. 373 and 341. Bank of California, of San Francisco, owner.

Mineral Chief Mining Company.—The property of this company is situated near the eastern base of the Sweetwater range, in the Patterson District. Here are four claims on a series of veins running a little E. of N. and W. of S. A great amount of movement has taken place along this fissure system, judging from the heavy clay seams and the broken condition of the ledge near the surface. The property is developed by one tunnel 750 ft., another 300 ft. long, and by a double-compartment shaft 200 ft. deep. Several veins have been cut, but so little work has been done on them that their character is not definitely known. T. C. Sharp, of Clinton, owner.

Mono Mine (Quartz).—It is situated on the northern slope of Mount Scowdan, on the western extension of the Gray Eagle. But little work has been done here. The characteristics of the vein and ore are similar to the Gray Eagle. See our VIIIth Report, p. 396. R. G. Montrose, of Lundy, owner.

Monte Cristo and Headlight Mines (Quartz).—These mines are situated in Lake Mining District, and a little south of the Mammoth. They are developed by a joint tunnel, which has been run a distance of 1,600 ft. from the west side of Mineral Hill. A vein was struck, but no ore has ever been extracted. See our VIIIth and Xth Reports, pp. 360, 371, 373, 375, and 341. Hon. P. Reddy, of San Francisco, owner.

Montecito Mine (Quartz).—It lies 6 miles N.E. of Lundy, and joins the Goleta on the south. On this claim two tunnels have been run, 38 and 80 ft. long, respectively, cross-cutting the vein, but without reaching the western wall. A shaft has been sunk 40 ft. The character of the ore is the same as the Goleta. D. E. Jones, of Lundy, Superintendent.

Native Wonder and Mono Queen Claims (Quartz).—These properties were discovered the past year and have been only slightly developed. The Native Wonder is situated on the north side of a steep cañon, west of Mono Lake, while the Mono Queen is opposite, on the south side of the cañon. The Native Wonder runs nearly E. and W., and has been opened by a short drift showing a vein 18 in. in thickness. The Mono Queen is a blanket vein, and has been opened by a tunnel 70 ft. long. The ore is honeycombed, and is said to be high grade. E. C. Mattly, of Mono Lake, owner.

Neal Mine (Quartz).—It is 6 miles S.W. of Benton, at an elevation of 8,000 ft. Here occurs a large vein of quartz, which, it is said, can be

traced for several miles both N. and S. The vein dips at an angle of 70° W., and shows very regular walls, the inclosing formation being granite. This mine was opened in 1878, but has been in litigation until recently. The developments consist of a tunnel 156 ft. long, and a cross-cut on the vein, where it is 27 ft. wide. From the end of the tunnel a shaft has been sunk 47 ft., with a cross-cut, toward the hanging-wall, of 17 ft. The great body of the ledge is low grade, but in the middle and on the foot- and hanging-walls there are rich seams. Along the walls the ore is much crushed and decomposed. The surface croppings are very prominent. Hon. P. Reddy, of San Francisco, owner.

New Enterprise, Bishop, Blackrock Consolidated, Adrian, and Ore Mines (Quartz).—These properties are situated in the town of Bodie. For a number of years they have lain idle, but a company has recently been organized by Messrs. Cain, McCone, and Kelly, of Bodie, to reopen them. See our VIIIth Report, p. 398.

Noonday Mine (Quartz).—This mine is situated one half mile south of Bodie. The property is at present being worked under a lease. No new developments have been made since the publication of our VIIIth Report. See our VIIIth Report, p. 396. Reese, Cameron, Kelly & Graham, of Bodie, owners.

Ontario Syndicate (Quartz).—The claims of this company, ten in number, are situated on the northern slope of Mount Scowdan. It is intended to develop them by means of a tunnel which has been commenced at an elevation of 400 ft. above Mill Creek. The tunnel has been run as a cross-cut for 100 ft., and from that point follows the course of a vein S.E. for 760 ft. The vein varies from a mere seam up to 6 ft. in thickness. In addition, considerable work has been done on the surface. Ontario Syndicate, of Lundy, owners.

Parrott Mines (Quartz).—They are situated on the N.W. slope of Mount Scowdan, at altitudes ranging from 9,000 to 9,600 ft. The veins occur in blocky argillite, feldspar-porphyry, and other hard, silicious rocks forming bold cliffs several hundred feet high. The *Grand Prize* claim lies to the west and includes several veins having a N. and S. direction, and dip to the W. The veins are generally small, sometimes reaching a width of 18 in. No underground developments have been made. The eastern claim is known as the *Bonanza*. Several veins are found on it. Enough work has been done to show that in places the ore is very rich. — Parrott, of Lundy, owner.

Rattler Mine.—This mine is situated on the north side of Ferris Cañon, in the Sweetwater Mountains. Here are two veins: one but slightly developed and carrying gold; the other, silver and gold. The latter runs N. and S. and dips about 50° W. This vein varies in width from a few inches to 3 ft. In many places it is high grade, the gold forming about one sixth of the value. The quartz is peculiar in showing numerous drusy cavities and in containing fluor-spar disseminated through it. The vein is opened by four tunnels, exposing it vertically for over 300 ft. The inclosing rock is a white porcelain-like porphyry. See our VIIIth Report, p. 362. Foulk, Kilpatrick & Brown, of Sweetwater P. O., Nevada, owners.

Rattlesnake Mine (Quartz).—It is situated in the Mono Diggings, 12 miles W. of Bodie. The country rock is granite. The vein runs N. and S. and dips at an angle of 25° W. In thickness it ranges from a mere seam up to 13 in. It has been stoped out on the incline to a depth of

133 ft. A two-compartment shaft has recently been sunk, cutting the vein at a depth of 155 ft. The ore is free milling and medium high grade. See our VIIIth Report, p. 363. M. J. Cody, of Lundy, owner.

Sacramento Mine (Quartz).—It is situated on the western slope of the White Mountain range, 15 miles N. of Bishop Creek. The vein occurs inclosed in granite, having an E. and W. course and northerly dip of 20° to 30°. The main portion of the ore shoot varies from 1½ to 4 ft. in thickness. The gold is found fairly evenly distributed and is mostly free. The mine has been worked in an irregular way for several years. It is opened by one tunnel about 250 ft. long. Higher up the hill a large amount of ore has been stoped out and one incline sunk on the vein to a depth of 300 ft. J. H. Bulpit, of Bishop Creek, owner.

Southern Belle Mine (Quartz).—It is situated at the western base of the White Mountains, 5 miles N.E. of Laws Station. The vein of gold-bearing quartz and limonite runs E. and W. in a magnesian slate, and dips at an angle of 35° N. The ore is generally soft and decomposed and easily milled. The pay streak varies from 8 in. to 2 ft. in width. The main tunnel is 225 ft. long. From the point of discovery an incline has been sunk on the ledge for a distance of 400 ft.; 270 ft. of this incline lies below the tunnel. The ore is raised this distance by windlass and then run in cars to the mouth of the tunnel. The ore is crushed in a 5-stamp mill, situated 1 mile N., and run by water power. Four other claims on different veins are owned by this company. O. E. Duenwig, of Laws P. O., Superintendent.

Spartan Mine (Quartz).—This mine lies S. of that part of the Sterling Company's mine which was formerly known as the *Detroit Copper Mine*. Two tunnels have been run to cross-cut the vein. The upper is 120 ft. long, of which 90 ft. is in mineralized vein matter. The other tunnel, 180 ft. below, has at present a length of 245 ft., and is being run through limestone. The vein matter is partly a mineralized limestone and partly a porphyry. M. R. Burus, of Lundy, owner.

Standard Mine (Quartz).—This mine is situated on the summit of the hill directly E. of Bodie. No new developments have been made in this mine since the publication of our VIIIth Report, in which it was carefully described. The work now going on is confined to that portion of the mine between the 300 and 500 ft. levels. An electric plant has been recently added, and is now in successful operation. (See special article on "Electrical Transmission" in this report.) The power is supplied by Green Creek, and the electricity is transmitted a distance of about 12½ miles. It is used at present to operate the mill only. A cyanide plant is in process of construction by the company for the purpose of working the tailings. The capacity is to be 100 tons per day. See our VIIIth Report, p. 385. Standard Consolidated Mining Company, of Bodie, owners; Thos. H. Leggett, Superintendent.

Sterling (Detroit Copper) Mine (Quartz).—The property of the Sterling Company lies about 6 miles N.E. of Lundy. One claim lies north of the Goleta, and on the same ore body, and the other south of the Montecito. The claim on the north has been opened by a shaft 115 ft. deep. That on the south was formerly known as the *Detroit Copper Mine*, and was described in our VIIIth Report, pp. 364 to 365. In past years a large amount of work was done on this mine in an attempt to extract copper from an E. and W. vein. Sterling Mining Company, No. 330 Pine Street, San Francisco, owners; D. E. Jones, of Lundy, Superintendent.

Syndicate Mine (Quartz).—This mine is situated 1 mile E. of Bodie, being the most northern of the Bodie group of mines. The mine is being worked under a lease at present. No new ore bodies have been found, and the work is confined to that left by the company. This mine, in connection with the others in the vicinity, was described in our VIIIth Report, pp. 382 to 401. See our VIIIth Report, p. 387. Parr & Tyack, of Bodie, owners.

Wild Rose Mine (Quartz).—This property is situated 8 miles S.E. of Benton. The vein runs N. and S. and dips W. The country rock is granite. It has been opened by a tunnel 300 ft. long, connected with the surface by a 150 ft. upraise. Below the tunnel three winzes have been sunk, 25, 36, and 125 ft., respectively. In the bottom the ore became more base, water being encountered 25 ft. below the tunnel. In the lower part of the workings silver is reported to have predominated and to be accompanied by a little galena. The ore is high grade. Where the vein has been worked it is said to be from 4 to 6 ft. wide. The mine has been abandoned for some time, but it is now the intention to open the old workings. See our VIIIth Report, p. 378. McNamara & Dowd, of Benton, owners.

Wolverine Mine (Quartz).—It is situated on the northern slope of Mount Scowdan, at an elevation of 9,700 ft. The vein is inclosed in granite, runs E. and W., and dips into the mountain at an angle of 25° to 30°. It is developed by an incline 70 ft. deep and by a tunnel 70 ft. long, connecting with the bottom of the incline. Some stoping has also been done. The width of the vein varies from a few inches up to 3 ft. The ore is free milling, though containing some sulphurets of iron. Lake Lundy Mill and Mining Company, of San Francisco, owners; R. G. Montrose, of Lundy, Superintendent.

MONTEREY COUNTY.

In this county there is only one group of gold mines. These mines are in the Los Burros District, in the Santa Lucia Mountains. These are the only gold deposits of any special value in the Coast Range south of Lake and Colusa counties. At the time of the examination of these properties by the Bureau representative, very little work was being done.

Grizzly Mine (Quartz).—This mine lies about three fourths of a mile to the east of the main camp of Los Burros District. The vein is inclosed in sandstone, and courses E., and dips N. It is rather bunchy, like the others in this district, due, of course, to the broken character of the country rock. The ore is high grade, running $60 to $100 per ton. The greatest depth reached is 160 ft. The ore is different from the other mines in the vicinity, the gold being very fine and not generally visible to the eye. Iron and arsenical pyrites and zinc-blende are also present. The vein varies from 10 in. to 4 ft. in width. See our XIth Report, p. 260. H. C. Dodge, of Mansfield, Superintendent.

Last Chance Mine (Quartz).—See our VIIIth, Xth, and XIth Reports, pp. 405, 580, and 260. The only work going on here at the time of our inspection in 1893 was the sinking of an incline on one of the veins. The old workings were not accessible. The inclosing rocks are sandstone interstratified with thin seams of shale, the whole so crushed that the bedding is hardly apparent.

NEVADA COUNTY.

In all essentials for making the business of mining profitable this county is particularly favored. It has railroad facilities, water power, adequate timber supplies, good wagon roads, and in the main mining centers a most delightful climate. It has been the cradle of quartz mining and milling in this State, and it is in this county that the depression which has been hanging over the mining industry shows the first evidence of being raised. Not only are several of the enjoined hydraulic mines making preparations to resume, in part, their former activity, but numbers of quartz mines that were compelled to suspend operations under the old methods of mining have been resuscitated under the new conditions, and apparently have a long lease of prosperity in store. Foreign capital has been brought into this county during the past year, and more is preparing to come, assuring business activity for the future, and an increased gold production.

Badger Hill Mine (Hydraulic and Quartz).—This property is situated in Cherokee District, 1 mile S.E. of Cherokee, and work is being carried on in a quartz vein that has been uncovered in the pit, known as "The English Mine." The vein courses N. and S., dipping E., in slate bedrock, with a width of 18 in. A shaft 12 by 4 ft. has been sunk 100 ft., at which depth drifting both ways on the vein has been commenced. The hoisting plant is run by water on a 4 ft. Pelton wheel under 150 ft. pressure. The quartz is dark colored, with about 6 per cent of sulphurets and arsenical pyrites. Should the vein continue as favorable in sinking the next 100 ft. a mill will be erected on the property. Badger Hill Gold Mining Company, of North San Juan, owners.

Baltic Mine (Quartz).—This property is situated in Secs. 34, 35, and 27, T. 18 N., R. 11 E., God's Country Ravine, in Eureka District, 7 miles from Washington and 5 miles S. of Graniteville. The property has been idle for some time, but a patent has lately been applied for, and as soon as issued the mine will be developed. The claim consists of 4,500 by 600 ft. on the vein, which courses N.E. and dips at about 45° E. A 378 ft. tunnel has cross-cut the vein at 35 ft. perpendicular depth; this block of ground has been stoped. Two pay shoots are known, 290 and 125 ft. long. The 20-stamp steam mill has a large-sized Blake crusher and roller, self-feeders. The grizzly is constructed of 1½ by 4 in. scantling, cut beveled on the long side, and covered with heavy strap iron; the bars set 1¼ in. apart. The mortars are extra wide above the dies, flaring, both in front and back, about 2 in. A back silvered plate 6 in. wide is used, and the lip of the mortar is covered with plate. The aprons are 5 by 5 ft., set on a grade 1 in. to the foot. The ore has to be hauled half a mile, at a cost of 60 cents per ton. The cost of milling by steam is $2 per ton, requiring a 40 horse-power engine. Cordwood costs, delivered, $2 25 per cord. The ore carries comparatively no sulphurets. See our VIIIth Report, p. 451. J. McBean et al., owners; W. H. Mead, of Washington, Superintendent.

Belle Fontaine Mine (Quartz).—This property is on Deer Creek, 3 miles E. of Nevada City, in Willow Valley District. The vein strikes N. 35° E., and dips W., in a granitic formation. The claim is 1,200 by 350 ft., and along the upper end several incline shafts and tunnels have been opened, exposing three or four ore bodies, pitching apparently to the south, with quartz from 4 in. to 1 ft. between walls. The quartz

carries 1½ per cent of sulphurets. A tunnel now being run near the lower end of the claim, 10 ft. above Deer Creek, along the hanging-wall of the vein, is 200 ft. perpendicular below the former workings, or 600 ft. on the pitch of the vein. Pay rock was encountered 230 ft. from the mouth of the tunnel, from 4 in. to 1 ft. wide. Opportunity for water power is found in the Manzanita and Snow Mountain ditches, both of which pass above the claim; timber is also plentiful. Belle Fontaine Gold Mining Company, of Nevada City, owners.

Brunswick Consolidated Mining Company (Quartz).—This property was described in our VIIIth, Xth, and XIth Reports, pp. 431, 381, and 274. The mine is located in Sec. 25, T. 16 N., R. 8 E., 2 miles S.E. from Grass Valley, and is working on a N.E. vein dipping to the S.E., between slate walls, with an average width of 2 ft. The quartz is of ribbon structure, with a good percentage of sulphurets (galena, zinc-blende, iron, and arsenical pyrites); as far as developed the vein appears to make in bunches or very short shoots. The mine is opened by a three-compartment, double-tracked incline shaft to a depth of 700 ft. on a 43° pitch for the first 300 ft., below which it straightens up to 80°. The last hundred feet of the shaft is narrowed down from 14 by 6 to 10 by 6 ft. in the clear. It is timbered throughout with sawed timbers and close planked. The mine is wet, requiring an 8 in. Cornish pump running six strokes per minute in summer and ten strokes in winter. The present workings consist in drifting west on the 700 ft. level and carrying an upraise to the 600 ft. level near a bunch of good-looking ore. Brunswick Consolidated Mining Company, of San Francisco, owners.

Cedar Mine (Quartz).—This property is in Bear River District, 14 miles from Grass Valley, in Secs. 20 and 29, T. 14 N., R. 8 E. The croppings of the vein can be followed for 4,600 ft. on its course N.E. across Wolf Creek. The vein dips W. between slate and diabase walls; to the east, in close proximity, runs a serpentine belt. Near the banks of Wolf Creek a 40 ft. shaft has been sunk and drifts run, disclosing a 23 ft. vein. The quartz carries a large percentage of copper sulphides, oxides, and native copper, with the gold. Numerous surface prospect-holes have been made along the croppings. J. R. Nickerson, of Auburn, Placer County, owner.

Centennial Gold Mine (Quartz).—This property was described in our XIth Report, p. 280. It is the south extension of the Osborne Hill vein, and claims 2,200 ft. on the ledge. The mine is now under bond; a new steam hoisting and pumping plant is being erected, and as soon as the water is pumped out a crew will be set to work. The vein has a N. and S. course, in syenite walls, pitches to the W., and is not very wide. H. Sylvester, of Grass Valley, owner.

Central Gravel Mining Company (Drift).—This property is on the Washington Ridge, 10 miles E. of Nevada City. A bedrock tunnel has been run on a S.E. course into the ridge, from the Deer Creek side, a distance of 900 ft., where the course is changed to the N., the expectation being that about 30 ft. farther it will tap the channel coming down the ridge. The tunnel has been run through slate at a cost of $4 50 per ft. The gravel is free, carrying washed gold worth $17 40 per ounce. The company have free water; more can be had by buying water from the South Yuba Ditch Company, and with 300 ft. pressure. They use 25 boxes (12 ft. long) set on a 4 in. grade per box, and supplied with slat

and Hungarian riffles. Central Gravel Mining Company, of Sacramento, owners.

Central North Star Gold Mine (Quartz).—This property was described in our XIth Report, p. 277, and is situated in T. 15 N., R. 8 E., 3 miles S. of Grass Valley. There are three veins in the claim. The main works are on what is supposed to be the extension of the North Star vein, in diabase, with an average width of 2 ft., coursing E. and W., and dipping at an angle of 52° N. There are two shafts, about 400 ft. apart, one vertical and the other an incline (52°). A drain tunnel 400 ft. long carries off the surface waters. At the incline shaft a steam hoist and a 6 in. bucket pump, to make six strokes per minute, are being erected. Jas. Bennallack, of Grass Valley, Superintendent.

Central Pacific Mine (Quartz).—This property is situated three fourths of a mile S.W. from Rough and Ready. The claim comprises 1,500 by 600 ft., and carries a vertical vein, coursing N. 10° E., from 6 in. to 1 ft. wide, between syenite walls. Moody & Gayety, of Gold Run, Placer County, owners.

Champion Mine (Quartz).—This property has been fully described in our VIIIth, Xth, and XIth Reports, pp. 420, 386 and 286. The mine is located in Secs. 11 and 12, T. 16 N., R. 8 E. Since issuing our XIth Report, the shaft has been sunk to the 1,200 ft. level, and new substantial hoisting and compressor plants put in place, enabling the workings to be carried to a depth of 3,600 ft. The capacity of the mill has been increased by the addition of 10 stamps. New grizzlies have been placed, with the bars set on edge. The stamps make 100 drops of 6 in., and have a 7 in. discharge through a No. 4 sheet-tin perforated screen, which lasts three weeks. The steel shoes last 100 days, with an average duty of 2¾ tons per twenty-four hours. The guides are of the best white oak; the sequence of the stamps is 1, 5, 2, 4, 3, feeding from No. 3. The sides of the mortars are supplied with linings and the front has an 8 in. silver plate. Two thirds of the amalgam is retained in the battery. The aprons, 14 ft. long, are set on a grade of 1¾ in. to the foot. The apron is scraped every other day, but the whole apron is dressed daily. The battery and battery-plate are cleaned up once a month. Between the battery-apron and the apron proper is a distributing box and quicksilver trap with an inclined bottom, in which any loosened amalgam is retained, while permitting the pulp to pass through onto the lower apron. The accumulated quicksilver is drawn off at the lowest point without stopping the battery. The rock carries 6 per cent of sulphurets, which are gathered from six single and one double Frue concentrator. These are worked in the company's chlorination works, which are arranged for saving gold, silver, and copper. About 110 men are employed, 86 underground. Champion Mining Company, of San Francisco, owners.

GRIZZLY AT CHAMPION MINE.

Conlon Gold Mining Company (Quartz).—This property is on Osborne Hill, 2½ miles S.E. from Grass Valley, and about 500 yds. W. of, and parallel with, the Osborne Hill Mine. The vein courses nearly N. and S., dipping 42° W., and carrying an average width of 26 in., with syenite wall rocks. The mine is being operated partly through an incline shaft, 9 by 5 ft. in the clear, with double compartments, 190 ft. deep, or 105 ft. perpendicular. A second opening is through a tunnel 237 ft.

long, which cuts the vein at a vertical depth of 50 ft. Two levels are being started from bottom of incline. Two air shafts connect with the tunnel, and the incline is ventilated by a blower using 4 in. air pipes. There are two shoots of ore pitching S.W. The timbering is done with sawed spruce, costing $19 per thousand. An 8 in. bucket pump keeps the mine free from water. A 10-stamp mill, under the same roof with the hoist, contains a Hercules rockbreaker, Hendy self-feeders, 750 lb. stamps dropping 6 in. 90 times a minute, and supplied with iron shoes and steel dies costing 6 and 11 cents per pound. The stamps crush 2 tons each per day through No. 35 brass wire screens; all the water being applied on the inside of the battery. The plates consist of one inside the battery, one on the lip of the mortar; the battery apron plate, 1 ft. wide, set on a 1½ in. grade; a second apron plate 5 ft. long with a grade of 1¾ in. to the foot, and a third apron plate 1 ft. narrower, set on a 2 in. grade; between each of the aprons is a distributor with ½ in. holes. The proportion of the amalgam saved in the batteries is given as 20 per cent, which is accounted for by the narrow mortars. The power is furnished by a 25 horse-power engine for the mill and pump, and a 15 horse-power for hoist and fan, together consuming 3 cords of wood daily, at a cost of $3 50 per cord. Fifteen men are employed, at an average of $3 per day. Conlon Gold Mining Company, of Grass Valley, owners.

Culbertson Gold Mine (Quartz).—This property is situated in the Eureka District, 2 miles from Graniteville; it is a prospect started on the extension of the National Mine. A tunnel has been started and buildings are being erected. D. J. Moore, of Graniteville, owner.

Delhi Mine (Quartz).—This property has been described in our VIIIth and XIth Reports, pp. 444 and 305. Since then the mine has been idle, as the expense of handling the 65 miner's inches of water that the mine makes has become too expensive. Delhi Mining Company, of North Columbia, owners.

Derbec Blue Gravel Mining Company (Drift).—See our VIIIth and XIth Reports, pp. 456 and 311. It comprises 647 acres. At present the company is working on the back channel, which shows a width of 75 ft. at the point of present operation; 45 men are employed. Theodore Wetzel, of North Bloomfield, Superintendent.

Diamond Creek Consolidated (Eagle Bird) Gold and Silver Mining Company (Quartz).—See our VIth, VIIIth, and Xth Reports, pp. 51, 440, and 389. It is in Washington District, in the Yuba Cañon, 28 miles E. of Nevada City. The several locations extend from the Yuba River to beyond the summit of the ridge toward Bear Valley. A peculiarity of this ledge is the intrusion of a dike into the vein, and on the pitch of the ore shoot, without any apparent faulting. The ore extracted at present comes from between the 400 and 600 ft. levels; about 40 tons is the daily yield. Forty-five men are employed, 30 underground. Diamond Creek Gold and Silver Mining Company, of San Francisco, owners.

Diamond Mining and Development Company (Quartz).—This property is on the Leeman ranch, 2 miles E. of S. from Grass Valley. The claim comprises 1,500 by 600 ft., with a N. and S. vein dipping about 30° E. The shaft, 4 by 8 ft., is 130 ft. perpendicular; at the bottom a drift has been driven 45 ft., and some stoping done. The wall rocks are syenite, and show near the vein a certain degree of stratification. Little timbering is required and not much blasting. A Cornish pump, with 5 ft.

stroke, runs six hours out of twenty-four. The hoisting and pumping are done with a small temporary steam plant. The quartz carries a fair percentage of sulphurets, mostly near the foot-walls, and for the present is crushed in a custom mill. Diamond Mining and Development Company, of Sacramento, owners.

Eagle Bird Mine (Quartz).—See Diamond Creek Consolidated.

Empire Gold Mine (Quartz).—See our VIIIth, Xth, and XIth Reports, pp. 46, 426, 371, and 272. The mine has been worked continuously for thirty-five years, and has produced over $5,000,000. At present it employs 80 men. G. Starr, of Grass Valley, Superintendent.

English Mine (Quartz).—See Badger Hill.

Ethel Mine (Quartz).—It is in Sec. 34, T. 18 N., R. 11 E., in Eureka District, and is a prospect. Location is 1,500 by 600 ft. on a vein about 4 ft. wide in granite, running parallel to the Baltic, with a N. and S. course. An incline shaft has been sunk on the vein 40 ft. M. H. Meade, of Washington, owner.

Federal Loan Mining Company (Quartz).—This property was described in our XIth Report, p. 290. Since then the shaft has been sunk from the 400 to the 600 ft. level on the pitch of the vein, and 500 ft. of a drift has been run E. at the 400 ft. level, and 100 ft. in length has been stoped. The ore shoot pitches E. A crossing makes into the ledge in the 300 ft. level W. and follows the vein down without faulting; crossing the incline and continuing to the E. it appears to affect favorably the mineralization of the shoot to the E. of it, the same widening rapidly as it goes down. In the bottom of the shaft where a station is being started, the vein shows 4 ft. wide, highly mineralized. On the 400 ft. level E. a heavy stream of water enters the drift under pressure, and a second heavy stream issues from the bottom of the shaft. It requires a 10 in. plunger pump, one of 8 in., two 6 in. bucket pumps, and a 4 in. pump, to keep the mine clear of water. The ground stands well with little timbering. The sinking of the shaft below the 400 ft. level has cost $15 a foot. Vincent & Brand, of Nevada City, owners.

Filibuster Mine (Drift).—See Lupine.

Gambrinus Mine (Quartz).—This property is in Eureka District, on Mill Ravine, 5 miles from Washington. It comprises a full claim of 1,500 by 600 ft., and is patented; also 25 acres for a mill site. The vein runs N. and S., between slate and granite, with an almost vertical dip, and has an average width of 4 ft. A tunnel starting from Mill Ravine, 650 ft. long, cross-cuts the vein 130 ft. below the surface. Former workings were carried down 80 ft. from the surface on the vein. A 5-stamp mill, run by water power, is to be moved to the mouth of the tunnel. See our VIIIth Report, p. 451. J. McBean et al., of Washington, owners.

Gold Flat (Potosi) Mining Company (Quartz).—This property is situated in Secs. 24 and 13, T. 16 N., R. 8 E., 2½ miles N. from Grass Valley and one fourth of a mile from Town Talk. The vein courses N. 10° E., dipping 45° E.; the vein is in slate, but near the contact of the same with the granite on the north. The average width is from 18 in. to 2 ft. A double-compartment shaft, 9 by 5 ft., has been sunk on an incline of 45° to the depth of 300 ft. At 212 ft. a level has been run S. about 830 ft. under the old Potosi shaft, cutting three pay shoots; the one nearest the shaft is 75 ft. long, the second 150 ft., and the third undetermined; at present it shows 200 ft. of pay ore. Along this course

several crossings from E. to W. cut through and throw the vein to some extent. At a depth of 60 ft. from the surface the old drain tunnel of the Potosi cuts the shaft, but as it is caved it no longer answers its purpose. The walls are solid, requiring little timbering. A 10 in. Cornish plunger pump with an 11 in. water pipe makes five strokes per minute; this and the hoist are worked by a 4 and a 6 ft. Pelton wheel; the latter, with 330 ft. pressure, runs the pump. Gold Flat Mining Company, of Grass Valley, owners.

Gold Hill (Nevada City) Mining Company (Quartz).—See our VIth, VIIIth, and XIth Reports, pp. 49, 418, and 288. It is situated in Sec. 11, T. 16 N., R. 8 E., 1¼ miles W. of Nevada City. The mine is still working above the drain tunnel, and is employing 38 men. A new hoist and mill are in contemplation. Gold Hill Mining Company, of New York, owners.

Grant and Canada Hill Mining Company (Quartz).—This property is in Sec. 17, T. 16 N., R. 9 E., 1¾ miles from Nevada City, and is being operated under bond at present. They are working on the extension of the Grant vein. The main Canada Hill is filled with water. A shaft is being sunk to the south on the Grant vein, which runs through the Canada ground. W. Veal, of Nevada City, lessee.

Harmony Gold Gravel Mining Company (Drift).—See our XIth Report, p. 298. It is 2½ miles N.E. from Nevada City. The property includes 280 acres, with 3,000 ft. along the course of the channel, and is opened through an incline shaft 340 ft. long on a 32° pitch, from whence a tunnel turns up the channel 1,800 ft. The main channel is 150 ft. wide, largely quartz gravel. The bedrock tunnel is in swelling granite. Twenty-five men are employed on two shifts, taking out 20 carloads of gravel of 1,500 lbs. weight per day. Since our last report a 10-stamp mill has been built and all the gravel passes through the mill. The power for the same is obtained from the Snow Mountain ditch, 30 in. of water being applied to a 4 ft. Pelton wheel, at a cost of 18 cents per inch. Harmony Gold Gravel Mining Company, of Nevada City, owners.

Hartery Consolidated Gold Mining Company (Quartz).—This property was described in our Xth and XIth Reports, pp. 378 and 283. It is on Wolf Creek, 2½ miles S.E. of Grass Valley. Hartery Consolidated Gold Mining Company, of Grass Valley, owners.

Home Gold Mine (Quartz).—This is a new undertaking, located 1¼ miles W. of Nevada City, on Deer Creek, adjoining the Providence Mine on the west. Peck's Ravine, on the west of the Providence Mine, plainly marks the contact between the granite and the diabase, and the Home company have commenced to develop a quartz ledge that crosses Deer Creek at this point, where, in an early day, some rich rock was taken out. — Moore, of Nevada City, Superintendent.

Idaho Mine (Quartz).—See Maryland.

Jack Rabbit Mill and Mining Company's Mine (Quartz).—The property was mentioned in our XIth Report, p. 278. Since then the incline shaft has been carried down to 270 ft., and two levels have been run below the drain tunnel, 75 ft. apart, and about 125 ft. long. The croppings indicate two veins, of which the one where the shaft has been sunk appears to be a west feeder to the main fissure, necessitating a cross-cut of at least 130 ft. to reach the main vein. No large ore shoots have as yet been developed, but active prospecting is being carried on. Jack Rabbit Mill and Mining Company, of San Francisco, owners.

Knickerbocker Gravel Mine (Drift).—This property is on Cement Hill, in Secs. 1 and 2, T. 16 N., R. 8 E., 1 mile N.W. from Nevada City, and appears to contain a part of the old river channel that comes from Sugarloaf Hill. The workings consist of a tunnel starting N.E., partly in the cement, carried so narrow and deviating so often from the original course, that, though 1,200 ft. in length, nothing definite is known about the channel sought for. It is said to be still 300 ft. to the north. Large, hard granite bowlders are frequently encountered on the bedrock, and in places pay gravel has been found in small bunches carrying coarse gold. Two men make 3 ft. per day drifting, taking out 4 tons of gravel besides. The gold is worth $17 per ounce. No timbering is done in the mine. L. D. Craig et al., of San Francisco, owners.

Live Oak Mine (Drift).—See Odin.

Live Oak and Minuet Mine (Quartz).—This property is on Grizzly Ridge, 2½ miles N. from Columbia Hill, and three fourths of a mile W. of Delhi. The vein runs N. and S., dipping about 75° E., and varies in width from 2 to 12 ft., between slate walls. The developments consist of several tunnels driven on the vein from the river side. The uppermost one is 125 ft. long; 112 ft. below is No. 2, 212 ft. long; and again 66 ft. lower, No. 3 has been driven 140 ft., giving a perpendicular depth on the vein of 450 ft. The lowest tunnel, No. 4, 80 ft. long, is 200 ft. farther down the hill, and is intended for the main working tunnel, being in the vicinity of an eligible mill site. One pay shoot, pitching north, has been developed. The quartz carries from 1½ to 2 per cent of iron pyrites, galena, and arsenical pyrites. Little timbering is required, and no water to speak of has been encountered. Water power under 500 ft. pressure is obtained by extending the Delhi ditch. McMahon & Jennings, of Columbia Hill, owners.

Lupine Gravel Mine (Drift).—It is on Washington Ridge, in Sec. 21, T. 16 N., R. 9 E., in Nevada City District. The present developments indicate that the gravel cut into is from an ancient ravine that leads to the main channel under the ridge. The gravel is angular, while the gold found with it is rounded, washed gold. A high rim rock on the flank of the mountain close to the Lupine tunnel, and pitching into the hill, and a second rim rock traced near the top of the ridge, indicate the course of the main channel. There are two claims, the Filibuster and the Lupine, making a total area of 320 acres. The developments consist of a 94 ft. perpendicular shaft, and below this is a bedrock tunnel in slate running N. toward the shaft, 254 ft. long. An upraise of 14 ft. cuts into ravine wash carrying washed gold. The course of this ravine is S. 10° E. A cut is being made diagonally across the wash to decide its width and depth. The elevation at the tunnel mouth by aneroid is 3,715 ft., and on the bedrock above the upraise 3,735 ft. That part of the ground included in the Filibuster has been hydraulicked partly. Judge Caldwell et al., of Nevada City, owners.

Manzanita Gravel Mining Company (Drift).—See our VIIIth and XIth Reports, pp. 458 and 302. It is situated half a mile N. of Nevada City, and comprises 160 acres. Two years ago it was started as a drift mine, having previously been hydraulicked. The incline shaft has, at the mouth, an elevation of 2,680 ft., and in its length of 260 ft. falls 56 ft. The tunnel running N. from the bottom of the shaft is 1,250 ft. long, and cuts into the channel about 3 ft. above the lowest part of the trough. The breast of the drift, which is still being driven ahead, is in

pipe-clay, and is closely lagged. The output per hour at present is 8 carloads of 27 cu. ft. each. The gravel drifts are timbered with 4 ft. posts and 6 ft. caps, and closely lagged, as a layer of sand forms part of the roof. The gravel is all small, no rock weighing over 10 lbs. being met with, and is nearly 2 ft. deep. The washing is done through 300 ft. of sluices 2 ft. wide, furnished with slat and Hungarian riffles; the first 80 ft. is cleaned up every week, the remainder once a month. The company own a water-right on Deer Creek, and conduct the water from near Scott's Flat through 7 miles of ditch. The gold is fine and sells for $17 50 per ounce. Manzanita Gravel Mining Company, of Nevada City, owners.

Maryland and Idaho Gold Mine (Quartz).—The Idaho Mine was described in our VIth, VIIIth, and XIth Reports, pp. 45, 425, 372, and 271; it is situated 1½ miles E. of Grass Valley. These properties, formerly separate mines, have now been brought under one management by purchase. The present workings are being carried on between No. 13 and No. 15 levels at the east end of the Idaho, and extending into the Maryland ground; this depth very nearly approaches sea-level. Only half of the stamps and concentrators were working. The aprons are scraped every day and the batteries are cleaned twice a month. The amalgam saved in the batteries is 66 per cent. The mine is ventilated through an air shaft in the Maryland ground, which is connected through chutes with the back end of No. 15 level, in the Idaho, and through which an exhaust fan 10 ft. in diameter draws the foul air, making the main working shaft a down-cast. Employés number 110; of these, 80 work underground. S. P. Dorsey, of Grass Valley, owner.

Mayflower Mine (Quartz).—See our VIIIth and XIth Reports, pp. 453 and 295. The property lies on the contact of granite and slate, where it changes from an easterly to a northwesterly course. Six ledges are included in the location, two N. and S. and four E. and W.; the two former with a dip of 45° E., the four latter with a dip varying from 20° to 70° S. With one exception all the veins are incased in slate walls. The Grant vein has both granite and slate walls. The property contains, besides the quartz veins, a considerable body of gravel that was worked under the hydraulic system; arrangements are now being made to drift on part of it. The different veins are designated as the Mayflower, Butterfly, Beckman, North Star, Big Blue, Floyd, and the Grant. They are opened up by tunnels: No. 1 being 1,700 ft.; No. 2, 400 ft.; No. 3, 1,000 ft.; and No. 4, 700 ft. long. These last two tunnels are on the Mayflower vein. The greatest perpendicular depth attained in the mine is not over 75 ft., but on the dip of the vein the depth is 250 ft. The greatest amount of development is on the Beckman vein, which lies very flat and follows the foldings of the slate; it carries a high grade of quartz, with a good percentage of sulphurets. The ore is reduced in a 4-stamp water-power mill; weight of stamps, 950 lbs.; these drop 95 times a minute, with 6 in. drop and 4 in. discharge, through No. 6 round-punched screens, crushing 1¾ tons to the stamp. The pulp passes over two aprons, the upper one 3½ by 4 ft., the second 3½ by 9 ft., and then from a distributor to a shaking-table, with side shake, and this yields a larger amount of amalgam than the second plate. The aprons are given a pitch of 1¼ in. per foot, the shaking-table ¼ in. per foot. From the shaking-table the pulp passes over Frue and Triumph concentrators. The quartz carries 2½ per cent of sulphurets. The plates

are scraped every day, and the battery cleaned up once a month. The power is derived from several Pelton wheels: an 8 ft. for the mill, a 2½ ft. for the crusher, an 8 in. for the concentrators, and a 5 ft. for the hoist, requiring 30 in. of water in all. Martin Bros., of Nevada City, owners.

Merrimac Gold Mine (Quartz).—This property was described in our XIth Report, p. 279, and lies in T. 10 N., R. 8 E., 2 miles N.E. of Grass Valley. Developments have been resumed under favorable auspices. Merrimac Gold Mining Company, owners; L. P. Goldstone, Superintendent.

Mistletoe Mine (Quartz).—This property is in the Rough and Ready District, three fourths of a mile S.W. from the town. It comprises 1,500 by 600 ft. The vein courses N. 50° E. and dips about 70° N.W., showing a width from 4 to 18 in. between hard syenite walls. An incline has been sunk on the vein 40 ft. The quartz carries about 3 per cent of sulphurets (iron and copper); it is hand-sorted, and the heavily sulphuretted portion sacked and shipped. The country around is poorly supplied with wood. C. J. Kent et al., of Rough and Ready, owners.

Monarch Claim (Quartz).—This prospect is three fourths of a mile from Rough and Ready. It comprises 1,500 by 600 ft. The vein courses N. 28° E., stands nearly vertical in syenite, and is about 4 ft. wide. A shaft has been sunk 53 ft., and is to be continued. Gayety Bros., of Gold Run, Placer County, owners.

Mount George Gold Mine (Quartz).—It is on Rush Creek, 3 miles from Nevada City, and controls 4,500 by 600 ft., to the west of the main granite and slate contact. The altitude of the mine is 2,300 ft. The main vein courses slightly N. of E. and dips about 62° S. The country rock is diorite, with partial slate casing along the vein. The vein shows 16 in. wide near the surface, but at a depth of 55 ft. (which is the depth of the incline shaft) it is several feet in width. The quartz carries a small percentage of sulphurets and is of low grade. North of the main vein about 25 ft. is a small ferruginous quartz seam with a course of N. 60° E. and pitching very flat, which makes into the main vein to the west. It is extremely rich in free gold, yielding at the rate of several hundred dollars to the ton, and is worked up in the hand mortar. Still farther north is another seam about 18 in. wide, and carrying a good grade of ore with copper sulphurets. Two shafts have been sunk, about 50 ft. apart, one on the main vein, the other on the feeder. The latter shaft is an incline 85 ft. deep; at 42 ft. a level turns 40 ft. on the seam. The shaft on the main vein is 55 ft. deep; a drift has been started at 40 ft. toward the other shaft, and in the bottom they have drifted 96 ft. on the main vein. A small prospecting plant, consisting of a 4 in. Cornish pump with 3 ft. stroke, making seven strokes per minute, and a hoist, are run by a 3½ ft. Pelton wheel and a 2½ ft. Knight wheel, working under 70 ft. pressure and using 12 in. of water. Timber is plentiful on the ground. J. E. Carter, of Grass Valley, Superintendent.

Mountaineer Gold Mine (Quartz).—This property, 1 mile W. of Nevada City, was described in our Xth and XIth Reports, pp. 384 and 287. South of Deer Creek the ore is low grade, and any ore below $7 is not worth handling, the vein being only 12 in. wide, and the wall rock extremely hard. The quartz is a ribbon rock, carrying an average of 2½ per cent of sulphurets. The mine has been a dividend-producer for

years. Forty-five men are employed. W. A. Dennis, of Nevada City, Superintendent.

Muller & Walling Claim (Quartz).—This prospect was mentioned in our XIth Report, p. 296. Two veins cross the claims, supposed to be the extensions of the Champion and Wyoming. On the latter an incline at the east end of the claim has been sunk 87 ft., using an overshot wheel for hoisting. At the west end a tunnel is being driven to strike this same vein; at present it is 120 ft. long. A good deal of surface work has been done, demonstrating the presence of a large body of quartz of a good paying grade. Muller & Walling, of Nevada City, owners.

National Gold Mining Company (Quartz).—This property, 1½ miles S.E. from Graniteville, was described in our XIth Report, p. 309, and comprises 2,000 by 600 ft. The vein courses N. and S., and dips about 75° E. between black slate walls, about a mile W. of the granite contact. with an average width of 6 ft. Three tunnels have been driven on the upper portion of the veins, of which No. 3 runs entirely through the ridge 368 ft. below the surface; at 123 ft. it cross-cuts the vein, which it follows for 400 ft. Near the mouth of the tunnel an incline shaft has been sunk 108 ft. and a drift turned S. 200 ft. on the pay shoot, the end of which has not been reached. Stoping 150 ft. in length and 32 ft. high has been carried on here. The lower workings are connected with the tunnel by an air shaft. The foot-wall of the vein is swelling ground and shows an 8 in. gouge. The quartz is ribboned and shows free gold on the face planes, and carries about 1 per cent of sulphurets (iron and galena) and occasionally tellurides. The mine makes about 2 in. of water, which is raised by an ejector 100 ft. on the incline, through a 4 in. discharge pipe with $\frac{3}{8}$ and $\frac{7}{16}$ in. nozzles. Timber costs 1½ cents for lagging, 2½ cents per running foot for split timbers, and $22 per thousand for lumber. Water power is derived from the Eureka ditch, using 15 in. under 200 ft. pressure, distributed on the following Pelton wheels: an 18 in. for the hoist, an 8 ft. for the mill, a 2½ ft. for the rock-breaker, and an 18 in. for the concentrators. The reduction works consist of a 5 ft. Huntington roller mill with grizzlies, Gates crusher No. 1, and Hendy self-feeder. Three aprons are placed below the mill, each 4 by 4 ft., with a $\frac{3}{4}$ in. grade to the foot. Two Frue concentrators handle the sulphurets. The mill crushes from 17 to 22 tons per day, using No. 6 slot-cut screens, which last three days. The quicksilver groove in the mill is drawn off once a day, and plates scraped daily and dressed with sodium amalgam; the entire mill is cleaned once a month. The yield from the battery equals the yield from the plates. Fifteen men are employed, miners receiving $2 per day and board, and mill men $2 50 and board. Estate of D. R. Killigan, North Bloomfield, owners.

Nebraska Mine (Drift).—See Odin.

Nevada City Mine (Quartz).—See Gold Hill.

Normandy Mine (Quartz).—This property is in Secs. 31 and 32, T. 16 N., R. 8 E., in Dead Man's Flat, 4 miles S.W. of Grass Valley. It is only a "prospect," and the vein is about 12 in. wide and is "pockety." Said to have produced a large sum. Senechal & Richard, of Grass Valley, owners.

North Banner Consolidated Tunnel Company (Quartz).—This property was described in our VIIIth Report, p. 420, and now comprises five claims. Since reported on, the mill has been moved near the mouth of the lower or drain tunnel, designated as the Woodville tunnel, and five

stamps added. The mine is being worked by eleven tributors. At different times the mine has been operated through four tunnels. The main working tunnels at present are the Woodville, on a level with the mill, also used as a drain tunnel, and the Dunnigan tunnel, 170 ft. above; all of the tunnels are connected. Below the Woodville tunnel a shaft has been sunk 500 ft., with a station for hoist and pumping plant placed at the mouth, and a drift turned south from the bottom of the shaft 400 ft. in good paying ore. The general course of the quartz veins is N. 38° W., with a dip varying from 30° to 45° E., and an average width of 2 ft.; they lie along the contact of the slate and syenite, the latter forming the hanging-wall. At present no work is being done below the Woodville level. North Banner Consolidated Company, of Grass Valley, owners.

North Bloomfield Gravel Mine (Hydraulic).—This property was described in our VIIIth Report, p. 454, and illustrated in our IXth Report, pp. 122 and 133. At present 40 men are working on a limited area, having complied with the requirements of the law as to impounding debris, it being elevated 60 ft. and deposited in a portion of the old hydraulic pit and retained therein by means of brush dams until the slimes have settled, when the water is passed through a shaft into the main outlet tunnel and dropped into the river.

At present one monitor with a 6 in. nozzle, taking water under 500 ft. pressure, is operating on a bank over 300 ft. high, with 140 ft. of solid gravel next to the slate bedrock. At the point of operation the bedrock was pitching away, showing the presence of either a deeper basin or another channel behind.

About 1,500 ft. of 5 ft. sluices, lined with 13 in. pine blocks, costing 11 cents per foot, board measurement, are used in washing the gravel. After passing through the sluices the waste material drops into an open elevator box, up which it is thrust by the water issuing from two 4½ in. nozzles under a pressure of 500 ft. The bottom is lined with 3 in. plates of manganese steel, costing 8 cents per pound, which has been found to withstand the friction of the rocks far better than the white iron plates formerly used for the purpose. The "giant" works during the night shift; the day shift pick the ground and break up the pipe-clay and gravel.

A deep cut in the bedrock is being carried up to the face of the present bank to enable the bottoming of the deeper portion of the channel. The normal output, when everything is working to full capacity, is 2 cu. yds. per miner's inch, but under the present restricted working the output is limited by the space available for the depositing of the debris. A clean-up is made twice a month. The gold is worth about $18 per ounce. North Bloomfield Gravel Company, of San Francisco, owners.

North Star Mine (Quartz).—See our VIth, VIIIth, Xth, and XIth Reports, pp. 44, 428, 376, and 270. It is one of the most important mining properties of the county.

The shaft in 1893 was 2,800 ft. deep on the incline, and the workings nearly half a mile from the collar of the shaft. There are 125 men employed, 115 of them underground.

The mill and its methods may be regarded as one of the best and most representative of the California milling process. From the entrance of the ore into the mill everything is worked by gravitation,

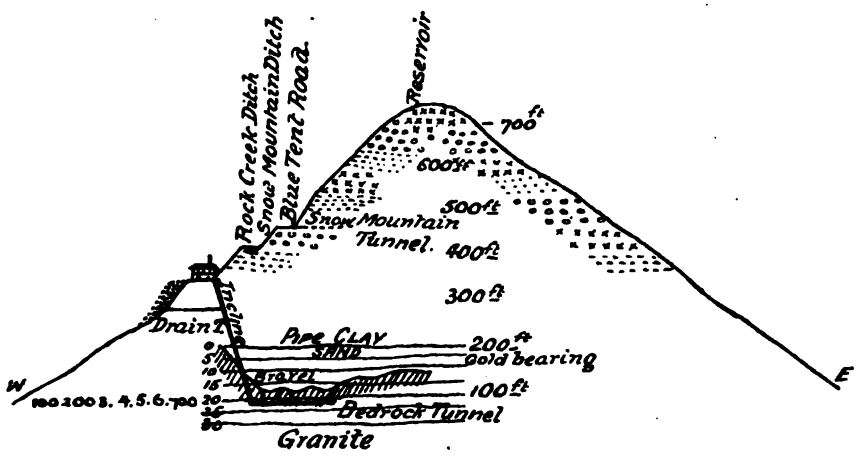
and the use of a shovel is rarely required. After passing over the grizzlies, which have their bars 2¼ in. apart, the fine material drops immediately into the ore-bins that supply the Hendy Challenge self-feeders, while the coarse rock falls into a bin that discharges through a chute into the Risdon rockbreaker, which itself discharges into the main ore-bin that leads to the feeders. The feeding of the battery is performed from the center stamp, the drops being so arranged that the pulp is forced from center to outside, and vice versa.

There are 40 stamps in the mill, weighing 850 lbs. each, dropping 86 times per minute, with a 7 in. drop and a 4 in. discharge. Steel shoes and iron dies are used, with an average life of 300 tons per stamp. The screens used are No. 10 perforated tin (English plate), costing 10 cents a plate, or 50 cents per screen, and last four weeks. The oak guides are long-lived, the upper set being co-existent with the mill. Plates are used in the battery. The duty per twenty-four hours is from 1¾ to 2 tons per stamp. The apron plates are divided into an upper apron of 18 in., followed by a second of 4 ft., having between them a narrow box with a perforated screen somewhat coarser than the battery screen. The batteries and concentrators use 15 in. of water. The aprons below them have a grade of ⅝ in. to the foot, and set to the same grade are 10 ft. of sluice plates. On six of the batteries these have a width of 30 in., while on the other two they have the same width as the apron plates; the latter give the better yield. The plates are scraped and dressed every morning. Beyond these plates the pulp is led onto a shaking-table 12 ft. long, formed of a silvered plate supplied with end motion, without jar, from an eccentric working underneath. The pulp is next passed through a trap to the concentrators (12 Triumph and 4 Frue), producing about one ton of sulphurets per shift; these are sold. One of the 6 ft. Pelton wheels has been replaced by a Dodds of equal diameter, effecting a saving of 10 in. of water, which costs 18 cents per inch. E. R. Abadie, of Grass Valley, Superintendent.

Odin Mine (Drift).—See our XIth Report, p. 301. The property includes what was formerly known as the Nebraska and Live Oak ground along the Blue Tent road. Two ditches pass over the property, insuring a plentiful supply of water; one at a level of 60 ft. above the gravel washing pit and another about 120 ft. above; this latter water is employed for running the hoisting works, while the former supply is used for washing. The hoisting works are supplied with both water and steam power, the latter as a reserve, but is made use of at present for running a small steam pump at the foot of the incline to assist the ejector.

The bedrock tunnel from the foot of the incline shaft has a general easterly course, cutting across the channel which runs with the general direction of the ridge, swinging perhaps slightly to the west. A section through the channel shows the west rim pitching 6 ft. in the 100; the main channel having a width of about 225 ft. to where the bedrock rim raises on a slope of 6 in. to 100 ft., making the entire width 1,500 ft.

From the gravel worked to the top is 550 ft., including five different beds of gravel, with alternating pipe-clay and trachytic tufa capping. Along the flat east rim the gravel is low grade, the best not yielding over 75 cents per carload, while in the deepest part the carload value increases rapidly, enough to make the entire workable portion yield a good profit.



SECTION THROUGH ODIN CHANNEL, HARMONY RANGE, NEVADA COUNTY.

The present plan is to drive ahead upstream on the western or deepest side of the channel, then to breast out on both sides back to the incline, after which a new double incline shaft will be started between the Rock Creek and Snow Mountain ditches on the course of the channel.

The high rim has been traced from an old shaft in Keystone Ravine to the upper end of the Howe hydraulic pit. The gravel has to be removed rapidly in the present workings, the ground swelling badly. From 8 to 10 men breast on a shift, producing 10 cars to the man; the working force numbers 25. The dump-house holds 100 carloads; the gravel is washed twice a day, and each week the dump is washed down clean. The upper boxes are cleaned twice a week; the gold, which is exceedingly fine, is worth $17 75 per ounce. The tailings are impounded and washed over again later. C. Hesse, of Nevada City, Superintendent.

Omaha Consolidated Gold Mining Company (Quartz).—See our VIIIth, Xth, and XIth Reports, pp. 433, 373, and 273. It is situated 1½ miles S. of Grass Valley, on Wolf Creek. The property comprises 2,400 ft. in length on the vein. It costs $6 per ton to mine and mill the ore in this mine, using water power throughout, and employing in mine and mill about 75 men. Omaha Consolidated Gold Mining Company, of San Francisco, owners.

Original Pittsburg Gold Mining Company (Quartz).—This property is in Secs. 18 and 19, T. 16 N., R. 8 E., and Secs. 13 and 24, T. 16 N., R. 8 E., 2½ miles N. of Grass Valley, comprising two claims (3,000 by 600 ft.). The course of the vein is N. 2° W., with a dip of about 45° E., and has an average width of 3 ft.; the quartz carries over 4 per cent of sulphurets. The present workings are carried on at the 500 ft. level; below this the mine is filled with water. On this level, drifts have been driven from the shaft a distance of 750 ft. N. and 280 ft. S. In the south breast a "crossing" has pinched the vein out, but from the surface indications it is plain that the vein continues beyond, and all that portion is virgin ground for 2,000 ft. A tunnel 280 ft. long is being

driven south of the main shaft to strike the vein 150 ft. below the surface. The entire plant, run by water power, is very substantial. See our VIIIth and XIth Reports, pp. 426 and 294. T. J. Furbee, of Grass Valley, Superintendent.

Osborne Hill Gold Mining and Milling Company (Quartz).—This property is 2½ miles S.E. from Grass Valley, controlling 2,100 ft. on the vein; patented. The vein courses N.W., dipping 28° W., and shows an average width of 14 in. Several ore shoots are known to exist, pitching south. The incline shaft is 450 ft. long and 250 ft. in perpendicular depth; the lower part is caved and filled with water. This shaft is being retimbered and cleaned out, and a pumping and hoisting plant erected to work the mine to a depth of 1,500 ft. Later a stamp mill will be erected, as a test run of the quartz shows the ore to be of high grade. The shaft is a double-compartment, 10 by 5 ft. in the clear; timbered with square timbers and closely lagged. The iron "T" rails used in the shaft weigh 12 lbs. per foot. Steam power will be used; cord wood (pine) costs $3 25 per cord. Osborne Hill Gold Mining and Milling Company, of San Francisco, owners.

Osceola Mine (Quartz).—This is 1 mile S. from Rough and Ready, and comprises 1,500 by 600 ft. on the course of the vein, which is N. 30° E., dipping W., with an average width of 3 ft. The quartz contains 2 per cent of copper sulphurets. The developments consist of surface cuts, two tunnels, and a 70 ft. incline on the vein; in the bottom of the latter is a 3 ft. vein. The Excelsior Water Company's ditch crosses the south end of the claim, and would give about 60 ft. pressure. Moody & Gayety, of Gold Run, Placer County, lessees.

Peabody Mine (Quartz).—This mine, 1,200 ft. long, is south of and within the city limits of Grass Valley. It courses N.W. and S.E., dips 30° S.W., and is 4 to 20 in. in width. Admission was denied, but it is said to have been exploited to the depth of 440 ft., and that the rock was high grade. J. H. Von Schroder, Eugene de Sabla, Jr., and Alf. Tregidgo, of Grass Valley, owners.

Pennsylvania Consolidated Gold Mining Company (Quartz).—See our Xth and XIth Reports, pp. 383 and 276. It is in T. 16 N., R. 8 E., about 1½ miles from Grass Valley, and controls 2,900 ft. on the vein, the surface side-lines varying from 300 to 600 ft. in width. The vein has a course of N. 33° W., and dips 60° S.W., with an average width from 6 to 22 in. between syenite walls. The incline shaft has a total depth of 625 ft., sunk on a varying grade, the upper part pitching about 60° and the lower about 36°. At present the vein carries small stringers of quartz, and the work being prosecuted is in the nature of prospecting. Eighteen men are employed. Pennsylvania Consolidated Gold Mining Company, of Grass Valley, owners.

Potosi Mine (Quartz).—See Gold Flat.

Providence Gold Mine (Quartz).—This property has been described in our VIth, VIIIth, and XIth Reports, pp. 47, 418, and 290. It is the deepest mine working on the granite and slate *contact* in the district, having attained the depth of 1,350 ft. on the pitch of the vein. It carries two veins, designated as the *front* and *back* veins; the former on the contact and the latter in the granite, about 500 ft. apart, and connected by a cross-cut on the 1,250 ft. level. Deer Creek forms the northern boundary of the property, which embraces 150 acres. The vein courses N.E. and dips S.E. The stopes above the 1,250 ft. level

are the principal sources of the present ore supply. The vein, averaging 5 ft. in width, yields between 70 and 80 tons per day.

On the south the drift on the contact has been extended on the 1,350 ft. level over 900 ft., and on the 600 ft. level 2,200 ft. The driving and stoping are performed by the aid of two machine drills, an Ingersoll and an Eclipse, operated by an old style compressor run by a 3 ft. Dodd wheel. A 10 in. Cornish pump with 3½ ft. stroke, running five strokes a minute, handles the water, and is operated by a 4 ft. Pelton wheel, in connection with the hoist.

In the 40-stamp mill, 30 of the stamps are dropping; these weigh 800 lbs. each, and are run at a speed of 100 drops of 6 in., with from 2 to 4 in. discharge through No. 6 perforated Russian iron screens. The shoes are chrome steel, with a guaranteed life of 155 working days, costing in New York 6 cents per pound. The dies are iron, and are obtained at the local foundry, lasting 70 days. The duty of the mill is 2 tons per stamp per twenty-four hours. No plates are used inside the battery; on the outside is a mortar plate 14 in. wide, with a ½ in. to the foot pitch, followed by an apron 4 by 4 ft. set on a grade of ¾ in. to the foot, succeeded by 12 ft. of double sluice plates, 12 in. wide. The mortar plate saves and retains 75 per cent of all that is caught on the plates.

The 12 Frue concentrators that are now in use produce from 3 to 3½ tons of sulphurets per day, which contain some cobalt and telluride. A new chlorination plant, of 3½ tons capacity, has been erected. The furnace is 65 ft. long by 11 ft., inside dimensions, with one step, 18 working doors, 12 in. height of firebridge. There are five gas tanks and five leaching vats, and four charges are made per day. Of the silver in the ore 85 per cent is saved. The furnace consumes three fourths of a cord of wood per twenty-four hours, usually cedar and pine, costing $3 50 per cord. The company owns and cuts its own timber and wood; the lagging, 5 ft. long, costs $4 50 per hundred. The company employs at present 80 men, 62 of these underground. Providence Mining Company, of San Francisco, owners.

Rainbow Gold Mine (Quartz).—The property is situated in the Eureka District, 6 miles N.E. of Washington, and an equal distance S. from Graniteville, in Sec. 34, T. 18 N., R. 11 E., and is being worked under a bond; it comprises 1,500 by 600 ft. The vein, 18 in. to 4 ft. wide, courses N.W. on a contact of porphyry and granite, the latter forming the footwall, and dips to the east. An incline shaft has been sunk 60 ft., and at present a tunnel is being driven to tap the vein below the shaft at a vertical depth of 140 ft.; it has reached a distance of 560 ft., and will require an additional 100 ft. before reaching the vein. A pay shoot pitching south has been traced 300 ft. The tunnel makes 2 in. of water. C. J. Garland, of Washington, owner.

Reward Gold Mine (Quartz).—This property is half a mile S.W. from Nevada City, and is a new undertaking. It is to the south of the Providence Mine on the California ledge immediately east of the Mountaineer Mine. The vein has a westerly course and dip, and lies in the granite. A shaft has been sunk 104 ft., and a steam pump and hoist are being erected. A long drain tunnel is now being driven from Deer Creek. R. C. Walrath, of Nevada City, Superintendent.

Rocky Bar Mine (Drift).—This property is on the Yuba River, one fourth of a mile E. of Washington, and comprises 3,000 ft. along the channel of the South Yuba River. A slide from the mountain on the

north side has covered the former channel, forcing the river over to the south, where it has cut a new channel, leaving a pronounced "run" between. On this an incline has been sunk 54 ft. deep at a pitch of 35°, and again 400 ft. farther up the channel a second incline is under way. A cross-cut of the channel shows a width of from 50 to 75 ft., with a depth of about 40 ft. of large, washed, granite bowlders, on a slate bedrock. The pay is all on the bedrock. A drift has been run up the channel between the two inclines 400 ft. long, partly on the bedrock. Timbers are required solely to keep the large bowlders from shifting. The gravel is hoisted by a 14 ft. overshot wheel and washed through 300 ft. of sluices, supplied with Hungarian and slat riffles, the boxes being set on a 4 in. grade. The gold is worth $17 per ounce. A Chinese pump, run by a 15 ft. overshot wheel, keeps the mine dry. Cañon Creek furnishes 75 in. of water for power. J. O. and E. A. Hayes, of Hillsdale, Santa Clara County, owners.

Rocky Bar Mine (Quartz).—This property is described in our VIIIth Report, p. 483, and is situated on Osborne Hill. The vein courses E. and W. and dips 30° S., in slate, averaging 1 ft. in width. Only the southwest end of the claim is being worked, by several companies of tributors working on feeders to the main vein; 48 men are thus engaged. The ore carries about 4½ per cent of sulphurets. H. Sylvester, of Grass Valley, owner.

Rocky Glen Mine (Quartz).—See our VIIIth and XIth Reports, pp. 450 and 310. The property has four known veins: two with a northwesterly course and an easterly dip, about 1,200 ft. apart, and two coursing more westerly and pitching southwesterly. C. D. Eastern, of Graniteville, owner.

South Idaho Consolidated Gold Mining Company (Quartz).—This property, comprising 3,000 by 600 ft., is 1 mile E. of Grass Valley, on an E. and W. vein, dipping about 75° S. It is about 18 in. wide, between serpentine and slate walls, and is being opened through a three-compartment incline shaft 5 by 12 ft. It is 70 ft. deep to date (August, 1893), and is to be sunk 100 ft. South Idaho Consolidated Gold Mining Company, of Grass Valley, owners.

Spanish Mine (Quartz).—See our XIth Report, p. 292. Average width of vein is 3 to 6 ft., between syenite walls. The incline shaft is 4 by 4 ft. to a depth of 120 ft., increasing then to 4 by 7 ft. to a depth of 270 ft. Two levels have been run from the shaft both N. and S. to pay shoots; that on the south is 175 ft. distant, and has been stoped on for 85 ft. The north pay shoot has just been touched. In the drain tunnel a pay shoot 80 ft. long has also been stoped. The drift on the drain tunnel level is 600 ft. long; on the next level, 150 ft. deeper, the south drift extends 375 ft. A. Lord, of Nevada City, Superintendent.

Spanish Mine (Quartz).—See our VIIIth Report, p. 442. It is a noteworthy property from the fact that it is the lowest grade of ore that is worked in California, where the cost is kept below the yield; said yield in itself not being over 50 per cent of the assay value. At present but two of the Huntington mills are running, crushing over 70 tons per day. The loss of quicksilver in working this ore is nearly one third from flouring. The yield of gold is 85 cents per ton; the cost of mining and milling about 53 cents. The works are to be removed to the mouth of a tunnel 300 ft. below its present location. There are 15 men employed in and around the works. F. W. Bradley, of Wardner, Idaho, owner.

St. Gotthardt Gold Mine (Quartz).—This property is 4 miles N. of Columbia Hill, and controls two claims, 3,000 by 600 ft., on a N. and S. vein, with an easterly pitch in syenite, varying from a few inches to several feet in width. A two-compartment perpendicular shaft, 5 by 10 ft., has been sunk to a depth of 380 ft. At a point between 300 and 400 ft. from the surface the shaft cuts the vein. Levels run at 200 to 300 ft. extend N. 500 ft. and S. 200 ft. At 180 ft. from the surface the shaft is tapped by a drain tunnel from the river side. A tunnel is also being run from Grizzly Cañon, where the mill is to be erected, to cut the shaft 340 ft. in depth; up to date it has attained a length of 900 ft.; 400 ft. more will bring it to the shaft. Steam power is used; engine 30 horse-power, cylinder 8 by 12 in., and boiler 48 in.; 1¼ cords of wood is consumed in twenty-four hours, costing $1 95 per cord. G. T. Wayman, of Columbia Hill, Superintendent.

St. Johns Gold Mine (Quartz).—See our XIth Report, p. 281. It is in Sec. 22, T. 16 N., R. 8 E., and comprises 3,500 ft. on the course of the vein, with a variable width. The vein courses N. 30° E. and dips about 70° S., with a diabase hanging- and a talcose schist foot-wall; the vein averages 4 ft. wide. The developments are made through an incline 350 ft. deep, with four levels at the respective depths of 90, 150, 230, and 300 ft. A contract has been let to continue the incline down 500 ft. The present workings are east of the shaft on the 300 ft. level; on all the other levels they are to the west. A 10-stamp mill with 4 Frue vanners has been acquired by the company, but has not yet been erected. The sinking of the shaft to date is 50 ft. below the 300 ft. level, and costs $50 per foot, and is being carried in the hanging-wall. St. Johns Gold Mining Company, of Grass Valley, owners.

San José Gravel Mine (Drift).—This property is in the Washington District, 6 miles E. of Washington, on Deer Creek, and is supposed to be a continuation of the channel worked by the Omega Company. It is being operated through a perpendicular shaft 340 ft. deep, well timbered, and closely planked; the gravel is hoisted in cars of 1,800 lbs. capacity, on safety cages. From the bottom of the shaft a bedrock tunnel is driven 600 ft. in the serpentine bedrock to the channel, which it crosses in 200 ft., about 18 in. higher than the lowest point of the channel, and is continued for 100 ft. in the north rim. Three upraises have been made in this portion of the rim; the first struck gravel at 15 ft., the second at 30 ft., but the third found no gravel in 75 ft. The general course of the channel is from E. to W. A drift has also been run 300 ft. up and 100 ft. down the channel. The gravel is dark, composed largely of cobbles of the country rock mixed with some quartz, and on the west side is covered with a layer of sand; the capping consists of 40 ft. of pipe-clay, and above that lava to the surface. The gravel drifts are carried about 7 ft. high. The mine makes about 6,000 gallons of water per hour, which is discharged by 6 in. and 8 in. Cornish pumps making six strokes per minute. Ventilation is supplied through a No. 2 Sturtevant blower, with 6 in. air pipes. The plant is operated by water power applied to three Pelton wheels under a head of 180 ft.: a 5 ft. wheel for the pumps, a 4½ ft. for the hoist, and a 6 in. for the blower, using in all 250 in. of water, costing $1 per day. Peter Long, of Nevada City, Superintendent.

Union Gravel Mine (Drift).—This property is in North Bloomfield District, on Relief Hill, 3½ miles from Bloomfield, and consists of 90

acres of patented ground. It was formerly a hydraulic mine, but is now being worked by drifting.

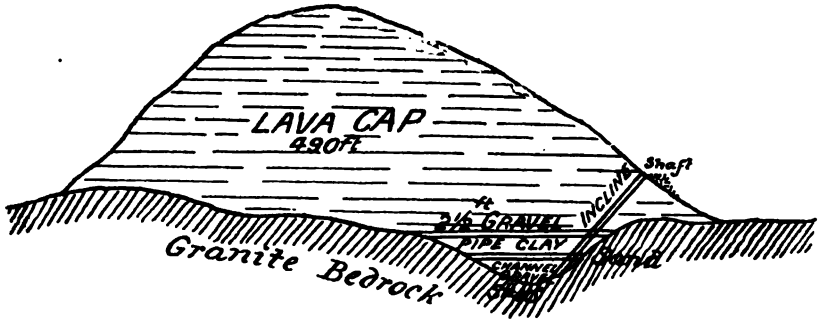
A tunnel is run north into the hill under the old hydraulic pit for 1,800 ft. in the slate bedrock, but develops no regular course for the gravel channel, which resembles more nearly a big slide from the ridge above, that has carried away parts of a former channel, or it may be an ancient bar. Both bedrock and gravel swell, making it hard to keep the gangways open. The gravel is over 40 ft. thick, capped with cement containing several strata of small quartz gravel. The channel is about 70 ft. wide and has been worked for about 300 ft. Intermixed with the gravel are clay and rotten serpentine bowlders. The gangway runs about 8 ft. above the main tunnel. The gravel drifts are from 5 to 9 ft. wide, timbered with square sets. In the main drift the posts are 6½ ft., the caps 4½ ft., with 6 ft. spread. The mine has natural ventilation through passageways opening on to the bank, which are connected with the main tunnel; it is also self-draining, making about 2 in. of water.

The dump at the mouth of the tunnel holds 350 tons; a smaller one, for prospecting, 100 tons; the gravel is washed three times every two weeks; the gold is coarse. The sluices are set in sections in Union Cañon, with drops of 20 and 60 ft.; the tailings are being retained in the cañon. Slat riffles and old car wheels are used in the boxes. The water supply is drawn from the Malakoff ditch, 200 in. of water being used. The mine employs 20 men. Union Drift Mining Company, of North Bloomfield, owners.

Wait for the Wagon Mine (Drift).—See Odin.

Washington Mine (Quartz).—This mine is on the Yuba River, 6 miles E. of Washington. A 20-stamp mill is on the property. See our VIIIth and Xth Reports, pp. 440 and 391. A. Tregidgo, of Grass Valley, owner.

West Harmony Gravel Mine (Drift).—This property was described in our XIth Report, p. 300, and is in Sec. 5, T. 16 N., R. 9 E. Since then



SECTION THROUGH WEST HARMONY GRAVEL CHANNEL, NEVADA COUNTY.

a 15-stamp mill has been erected; it crushes about 6 tons per stamp per twenty-four hours. The stamps drop 4 in. 95 times per minute, discharging through No. 2 perforated tin screens with a double discharge. The aprons are 4 ft. long with 1½ in. grade per foot, followed by 16 ft. of double sluices 16 in. wide, and supplied with Hungarian riffles. Beyond the mill 100 ft. of sluices and a canvas plant are to be added.

The plates are scraped once a week; the batteries and sluices are cleaned once a month; the gold is worth $17 50 per ounce.

The accompanying ideal sketch shows the relative positions of the different strata of the channel; it is 250 ft. from rim to rim. The bedrock is very irregular in its grade along the channel, rising at times 4 ft. above the level of the drift, and again dipping below the established grade. The gravel drifts are carried 6 ft. high, using two caps on three posts. The channel has been developed for a length of 500 ft.—300 ft. down and 200 ft. up. Two shifts of men work in the mine. West Harmony Gravel Company, of Nevada City, owners.

Winfield Scott Mine (Quartz).—See our XIth Report, p. 283. It is 3 miles S.E. from Grass Valley, and has been worked by the Hartery Mining Company, which owns the adjoining claim. Winfield Scott and Hartery Mining Company, of Grass Valley, owners.

Wyoming Gold Mining Company (Quartz).—This claim was described in our VIth and XIth Reports, pp. 48 and 291, and is in Sec. 11, T. 16 N., R. 8 E. The present workings at the south end comprise an incline shaft 900 ft. deep on the pitch of the vein. The vein being worked is the most westerly of the series; the same one as the back vein of the Providence Mine, 500 ft. from the contact, with which it unites at a depth of 500 to 600 ft. No stoping is being done. The only pay taken out is derived from running the drift ahead. Wyoming Gold Mining Company, of San Francisco, owners.

W. Y. O. D. Mine (Quartz).—This property is S. of Grass Valley. Admission to the mine and all information were refused. See our VIIIth, Xth, and XIth Reports, pp. 435, 379, and 268. W. Y. O. D. Mining Company, of Grass Valley, owners.

ORANGE COUNTY.

Included among the mineral resources of this county are gold, silver, lead, zinc, coal, copper, and cinnabar, none of which are mined extensively. Of all the minerals, coal has hitherto been the most prominent, but it is probable that some day petroleum may become the leading mineral production.

Several prospectors were engaged, in 1894, in searching for gold in Trabucco Cañon, about 30 miles E. of Santa Ana. Their discoveries were not of a promising character, however. The workings were in a light gray feldspathic porphyry, carrying iron sulphurets and a small amount of gold, too little to pay.

PLACER COUNTY.

Though containing a very large area of auriferous gravel deposits, yet from the great diversity of its resources, Placer County has suffered less in its advancement and material prosperity through the closing of its hydraulic mines, than any other portion of the State. Here, as in other parts of the great mineral belt of the State, capital is beginning to inquire into the possibility of resuscitating and developing the quartz interests, which have, up to the present, taken only a secondary place in the production of gold. More especially is this to be noted in the Ophir and Duncan Hill districts, which, from the mineral character of their veins, presented difficulties to the earlier quartz miners that made suc-

cess in their operations doubtful. Better acquaintance with the treatment of this class of ores at the present day, and improved methods of working, have largely removed the difficulties, and this section of the country may be expected soon to take a prominent position as a gold producer, as well as a favored land of fruit.

The large drift mines on the Forest Hill and Iowa Hill divides are pushing their developments ahead with uniform success, and as the courses of these ancient channels are more plainly understood, new sections are being opened, with every prospect of remunerative returns. It is much to be desired that the work of mapping these ancient river courses, so ably commenced by Ross E. Browne, E.M., and others, and which were given to the mining public in our Xth Report, might be extended over a large area.

Allbright Claim (Drift).—It is 2 miles E. of Penryn, and was formerly hydraulicked, but is now being prospected by drifting. A bedrock tunnel has been run in the slate 500 ft., and from the end an upraise of 32 ft. extends into the gravel, but little pay was found. The water issuing from an old tunnel on the ground is used for washing, through six boxes with 1 in. grade to the foot; slat riffles are used.

Alta Development Company's Mine (Drift).—It is at Alta, on the C. P. R. R., and comprises about three quarters of a mile on both the "White" and "Blue" channels. A tunnel, whose estimated length to tap the latter is 2,000 ft., is now being excavated. Towle Bros. & Gould, owners; Col. J. E. Doolittle, of Dutch Flat, manager.

American Bar Mine (Quartz).—This property is 2¼ miles S.W. from Michigan Bluff, and contains two locations of 1,500 by 600 ft. The vein courses N.E. and dips 45° E., between slate walls, from 8 to 40 ft. apart. It is worked by three tunnels; the lowest is 250 ft. beneath the surface. These tunnels are 150, 300, and 1,500 ft. in length; the upper one is connected with the surface by a 40 ft. shaft. The quartz carries some iron sulphurets and a little galena. Near the river is a 10-stamp mill, with 850 lb. stamps, run by a "hurdy" wheel. J. Nouges et al., of San Francisco, owners.

Baker Divide Mine (Drift).—See our VIIIth Report, p. 466.

Barton Mine (Drift).—This claim is 3 miles E. of Rocklin, in Sec. 20, T. 11 N., R. 7 E., and consists of 40 acres. It is an old river channel, presumably part of the delta of the precursor of the present American River, on a granite bedrock. The gravel deposit is 60 ft. deep and without capping; the bottom 6 or 7 ft. are mined. The gravel is cemented, containing no bowlders; the cobbles are very uniform in size, about like a man's fist. The gold is fine and flaky, and sells for $19 per ounce. The mine was opened in 1892, and has been worked to date through an upright circular shaft 6 ft. in diameter and 60 ft. deep. A second incline shaft farther down the channel will be ready for use shortly; it is 250 ft. on the incline. Through the circular shaft, not timbered, the car with 500 lbs. of gravel is hoisted by a horse-whim. The gravel is delivered to a Cox pan, which disintegrates the cemented gravel and passes it to the sluices; these are 200 ft. long, 16 in. wide, 12 in. deep, lined with Hungarian riffles, and set on a grade of 1 ft. to the box. Fifty carloads can be delivered to the pan in twelve hours. The tailings dump into Secret Ravine.

The width of the deposit worked is 350 ft.; the elevation above sea-level of the bedrock is 240 ft. The quantity of water used is 30 in., but

after the incline shaft is completed 60 in. will be used under 110 ft. pressure from the South Yuba Ditch Company, through 2,700 ft. of iron pipe 15 in. in diameter. Water is available all the year. A Worthington pump, working four hours per day, discharges the water from the mine. Dr. O. L. Barton, of Rocklin, owner.

Belvoir (Bowlder) Extension Mine (Quartz).—This property is in the Ophir District, 3 miles N.W. from Newcastle. The claim comprises 1,500 by 600 ft. on the vein, which courses N. and dips 45° E., and has a width of several feet; the country rock is a dioritic granite. It is an old mine being reopened. A shaft has been sunk 150 ft. and preparations are being made to drift. L. Ferguson et al., of Ophir, owners.

Ben Franklin Mine (Drift).—This claim, in Forest Hill District, is near Yankee Jim's, and comprises 160 acres on Swindle Hill. It is an ancient channel, capped with 200 ft. of cement, near the forks of Brushy and Devil's cañons, coursing N. and S.; the elevation of the bedrock is 2,350 ft. It is worked through a bedrock tunnel 1,200 ft. in length, which cost $12 per foot, and lies 20 ft. below the channel. The gravel is cemented, carrying about 60 per cent of bowlders and cobbles; the gold is worth over $19 per ounce. The gravel breasts are 25 ft. deep, and the drifts are 3 ft. high. Very little timbering is required, only an occasional post and cap. Ventilation is obtained by a water-blast. The water used (100 in.) is brought from the neighboring cañons through a mile of ditch. J. N. Burke et al., of Yankee Jim P. O., owners.

Big Dipper (Harmon) Mine (Drift).—This claim was described in our VIIIth Report, p. 472, under the name of the Harmon Mine, and is in New York Cañon, between Prospect and Wisconsin hills, in the Iowa Hill District. The property contains four locations, comprising 200 acres on a channel coursing N. and S. and over 200 ft. wide. The gravel has a depth of 130 ft., with a slight soil capping, and carries from 60 to 70 per cent of cobbles and bowlders; it is cemented. The gold sells for $18 15 per ounce. The bedrock tunnel, 37 ft. below the channel, is 700 ft. in length, requiring no timbers, and cost $6 25 per foot. There are two air shafts: one 73 ft. deep and the other not connected yet; these were sunk for $4 per foot. The two gangways are respectively 350 and 390 ft. long, and cost $4 per foot. The channel breasts are 370 ft. wide and the gravel is drifted 6 ft. high; these drifts are timbered with single posts and caps 8 ft. apart. The main tunnels are driven by Ingersoll drills worked from a Firth & Rix compressor. Two shifts of 15 men are employed, taking out from 65 to 70 carloads (2,200 lbs.) per day. They have worked 1,200 ft. of the channel up to a late date. Bryan rollers were used in crushing the cemented gravel; these are being replaced by 10 stamps of 950 lbs. weight, calculated to crush 70 tons per day. The plant is supplied with both steam and water power. The source of the water supply is Shirt-tail Cañon, whence it is brought through 7½ miles of ditch and delivered under 173 ft. pressure. There are 37 men employed. C. Waterhouse, of San Francisco, owner.

Bowlder Mine (Quartz).—This property is situated 3 miles N.W. from Newcastle, in the Ophir District. The claim consists of 900 ft. on the line of a 3 ft. vein, which courses N. 10° E., dipping 45° E. The walls are grano-diorite. The mine is opened by shaft and tunnel, both connected at a depth of 115 ft. The tunnel runs with the ledge for 300 ft.;

near the tunnel mouth the vein is faulted. Three different ore shoots pitching east are being worked. The quartz is ribboned and glassy and carries sulphurets. Dr. M. Schnabel, of Newcastle, owner.

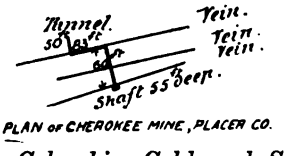
Breece & Wheeler (Paragon) Mine (Drift).—See our VIIIth and Xth Reports, pp. 467 and 455. It is 2½ miles E. of Forest Hill. At the present time two shifts of 15 men work in the mine, extracting 37 carloads of one ton each per shift. The gold is worth $18 per ounce. Messrs. Breece & Wheeler, of San Francisco, owners.

Buttes Mine (Quartz).—See our VIIIth Report, p. 461.

Cedar Creek Mines (Placer).—They are near Dutch Flat, and consist of gravel beds of vast extent, having an original depth of over 400 ft., and extending for over 6 miles without any capping. The channel has a top width of 1,500 ft. and 600 ft. on bottom, carrying pay throughout. Over 150 ft. of the bottom gravel is untouched. The general course of the channel is N. and S.; below Dutch Flat it forks, one branch going to the S.W. the other to the S.E. Up to date over $8,000,000 has been taken from this ground, and it is estimated that double this amount is awaiting recovery. In one of the hydraulic pits a shaft has been sunk through the gravel 150 ft. to bedrock, showing good pay all the way down. The gravel is not cemented. Some of the bowlders have been crushed in a small mill, and gave small returns in gold; at present quartz bowlders are shipped from here to the smelter for flux. Efforts are to be made to work portions of the ground by drifting. Gould et al., of Dutch Flat, owners.

Champion Mine (Quartz).—This property is 1½ miles S. from Turkey Hill, and is idle at present. The claim contains two locations on the southern extension of the Daniel Webster. The vein courses N. and S., dipping 75° E., between slate walls. Developments consist of an incline shaft 40 ft. deep on the vein, connected with a tunnel 150 ft. in length, with a second tunnel 50 ft. lower, cross-cutting for the vein. C. Knopfel, of Michigan Bluff, owner.

Cherokee Mine (Quartz).—It is in the Last Chance District, 16 miles E. of Michigan Bluff, and consists of 1,500 by 600 ft. The main vein is 18 in. wide, in slate walls, and courses N.W. and dips 70° E. The quartz is of ribbon structure, carrying about 2 per cent of iron sulphurets. There are three seams in all. On the bank of Deep Cañon 500 ft. of fall for water power can be obtained.



PLAN OF CHEROKEE MINE, PLACER CO.

Columbia Gold and Silver Mining Company (Quartz).—They own 3,200 ft. on a vein in the Ophir District, 7 miles W. from Auburn. The property, which comprises 250 acres of ground, is owned in Denver, Colo., and besides the mine, contains considerable agricultural and fruit land. The elevation is about 500 ft. above sea-level. The vein has an average width of 4 ft., and can be traced by the outcrop along its course, which is N. 10° W.; it dips 84° E. The walls are grano-diorite. Several feeders of prominence make into the vein in the company's ground from the west. The developments under the present management include three shafts, the erection of a hoisting plant and a new mill, besides several buildings for boarding-houses, offices, etc. There are three shafts available for working purposes. The main shaft, in the mill building, is a double-compartment, 5 by 13 ft. in the clear, furnished with double-reel hoisting gear. At the south end of the claim is the

former working shaft, 630 ft. deep, but at present filled with water. The third shaft, between these two, has just been started. The quartz carries 0.5 per cent of sulphurets. The mill is the Huntington rotary, with Woodbury concentrators. The ore-bin is constructed to carry 250 tons. The works will be lighted with electricity. The water power, derived from the South Yuba Canal Company's ditch, furnishes 410 ft. fall through one mile of pipe, which is applied to a 4½ ft. Dodd wheel for the hoist, a 6 ft. Pelton wheel for the compressor (running 12 Ingersoll drills), a 5 ft. Pelton wheel for the mill, and two 18 in. Pelton wheels for the concentrator and dynamos. Forty-five men are employed. Columbia Gold and Silver Mining Company, owners; B. F. Hartley, of Auburn, Superintendent.

Crater Mine (Quartz).—This property is in the Ophir District, 1 mile N.W. from Ophir. The course of the 2½ ft. vein is N. 80° W., dip 48° S. It is near the contact of the grano-diorite and amphibolite, but wholly in the latter. A shaft 800 ft. deep is on the vein. At present two men are overhauling the very extensive dumps. C. F. Reed, of Auburn, owner.

Daniel Webster Mine (Quartz).—This property is in the Forest Hill District. The claim consists of 1,500 ft. by 600 ft. on a vein coursing N. and S., dipping 75° E., between slate walls; its width is from 3 to 6 ft. It has been developed through three tunnels; the longest is 125 ft., and gives 75 ft. backs on the vein; at present a tunnel is being run south of the old works. Mrs. S. A. Powers, of Michigan Bluff, owner.

Dardanelles Mine (Drift).—This claim was described in our VIIIth Report, p. 464, and is situated in the Forest Hill District, 1½ miles S.W. from the town of Forest Hill. It contains 312 acres, and is operating on two beds of gravel. The bedrock tunnel, 2,700 ft. long, is run on a N.W. course, from the end of which an incline 330 ft. long, on a one third pitch, reaches the bottom of the channel, which has a N. and S. course. The elevation of the bedrock at this point is 2,551 ft. The gangway extends 630 ft. up the channel. The breasts are from 70 to 80 ft. wide, and are run 6 ft. high. The cemented gravel carries about 40 per cent of cobbles and bowlders. The gold is small scale, from .883 to .886 fine. At the head of the incline is an electrical engine for hoisting, capable of developing 500 volts; also an electrical pump, which is run four hours per day, discharging a steady stream through a 4 in. pipe. The bedrock tunnel, incline, and principal stations are lighted by incandescent lights calculated to burn for one thousand hours. The mill is furnished with both steam and water power, the latter being brought from Volcano Cañon through 9 miles of ditch and delivered under 300 ft. pressure. The water season lasts from November to July. J. Hamilton, of Auburn, owner.

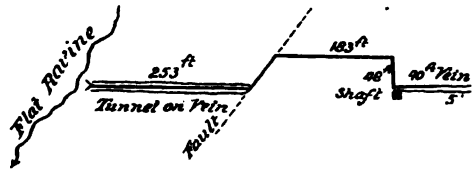
Dorrer Mine (Quartz).—This is situated in the Humbug District, near Damascus, on the South Fork of the North Fork of the American River, and consists of a claim 1,500 by 600 ft. The vein courses N.W. and dips about 80° E. It has an average width of 4 ft., and is between slate walls. The developments consist of three tunnels, 40, 200, and 200 ft. long, about 100 ft. apart and 80 ft. below the surface, and are connected therewith through an air shaft. The tunnels are run on the foot-wall slate and require no timbering. The pay shoot has been followed for 150 ft. without reaching the end, and about 40 ft. of the ground has been stoped. An incline tramway 3,000 ft. long, on a 35° grade, connects the mine with the 10-stamp mill. The mill is supplied with a

grizzly, a Dodge rockbreaker, Tulloch ore-feeder, and 950 lb. stamps, operated by a 3 ft. Knight wheel under a 30 ft. head. Several thousand inches of water can be supplied. The plating in the mill consists of a 4 ft. apron and 12 ft. of sluice plates, 14 in. wide, set on a pitch of 1½ in. to the foot. The quartz carries 2 per cent of iron pyrites, chalcopyrite, galena, and zinc-blende. The sulphurets are not saved. Five hundred tons of ore were crushed last season. Timber is abundant. Dorrer Bros., of Towles, owners.

Drummond Mine (Quartz).—See our Xth Report, p. 424. It is situated between the North and South Forks of Shirt-tail Cañon. The property comprises 360 acres of excellent timber land, through which the Drummond ledge courses, and also its probable feeder, known as the Eclipse; the latter has lately developed some extremely rich quartz. The two veins are about 400 ft. apart. Tunnels have been run on both veins; that on the Eclipse shows rich quartz in the breast. In the bottom of the works on the Drummond is a 2½ ft. vein of quartz. The steam mill contains two 5 ft. Huntington mills, a Blake crusher and Hendy self-feeders, 10 ft. of apron plates, and a Johnston and two Frue concentrators. B. F. Reed, of Auburn, owner.

Eclipse Mine (Quartz).—See our Xth Report, p. 433. It is near Ophir.

Flat Ravine Mine (Quartz).—This property is on Canada Hill, and comprises 1,500 by 600 ft. on a N.W. vein dipping 60° E. The foot-wall is slate, the hanging-wall porphyry, with 3 ft. of quartz between. The quartz carries 4 per cent of sulphurets, mostly iron. A shaft has been sunk 47 ft. on the pay shoot, and 598 ft. of tunnel run. A cross-cut has been run, and the shaft will intersect it at a depth of 177 feet. The mine is at the foot of Bald Mountain, at an elevation of 6,000 ft. above the sea. There is no mill on the property. M. Savage, of Michigan Bluff, owner.



PLAN OF FLAT RAVINE MINE, PLACER CO.

Golden River Mine (Drift).—See our VIIIth and Xth Reports, pp. 476 and 456. It is situated 2½ miles E. of Damascus. The company owns 3½ miles of the channel. There are three ancient channels on this divide on different levels; the upper, or white channel; the second, 30 ft. lower, has gravel, partly quartz and partly metamorphic rocks; and the lowest, 60 ft. below, known as the blue channel. The cement capping varies from 4 to 1,000 ft. in thickness. In the blue channel the gravel varies in thickness from 7 to 16 ft.; its course is a little N. of E. The elevation of the bedrock above the sea is 3,853 ft.; that of the bedrock in the nearest ravine, 3,813 ft., and the level of the North Fork of the American River is 2,000 ft. lower. The mine is opened through a bedrock tunnel 23 ft. under the channel.

From 75 to 100 carloads of gravel are extracted per day, working two shifts with 16 white men and 30 Chinese; the iron cars have a capacity

of 22 cu. ft. (one ton). The gravel, taking the average for the last five years, is valued at $2 50 per ton; cost for extraction, from $1 25 to $1 60 per carload. The gravel is mostly free. The channel drifts are carried 10 ft. wide, and the gravel drifts are from 7 to 16 ft. in height. The gravel has 33 per cent of cobbles and bowlders, all stowed in the mine.

For washing the gravel, water is brought from Humbug Cañon and collected in a tank 16 by 16 by 8 ft., and this amount of water, under a 36 ft. head, washes 20 carloads of gravel, which passes through 50 ft. of boxes with slat and Hungarian riffles; these are cleaned every two or three days. The gravel then passes through 180 ft. of boxes that are cleaned once a month, and 100 ft. of ground-sluice, then through 100 ft. of flume, finally passing through a series of parallel boxes followed by a drop. Blocks, car wheels, and riffles are used in the lower series of boxes, also quicksilver. The boxes are 15 in. wide and have a 1½ in. grade to the foot.

The gold is scaly, very uniform in size, and .932 to .937 fine, equal to $18 90 per ounce. The average production since 1888 has amounted to over $60,000 per annum. One mile of the channel has been worked. Golden River Drift Mining Company, owners; C. H. Hoffman, of Damascus, Superintendent.

Gold Blossom Mine (Quartz).—See our Xth Report, p. 431. It is situated 1½ miles N.W. of Ophir, and comprises 6,000 ft. on a vein running nearly E. and W. and dipping slightly S. A new 20-stamp mill is now (September, 1894) being erected on the property. A plant was erected here to work by the MacArthur-Forrest process, but was abandoned for lack of success. Col. B. F. Reed et al., of Newcastle, owners.

Gold Run Ditch and Mining Company (Hydraulic).—Their property is at Dutch Flat. The channel courses N. and S., the gravel being several hundred feet in depth. It has yielded largely in gold. Gould et al., of Dutch Flat, owners.

Green Mine (Quartz).—This property is near Ophir, immediately E. of the Crater vein, and shows an 18 in. vein, with heavy mineralized walls, and is "pockety." A shaft has been sunk on the vein about 300 ft. deep. An old 8-stamp mill stands on the property.

Harmon Mine (Drift).—See Big Dipper.

Hidden Treasure Mine (Drift).—See our VIIIth, IXth, and Xth Reports, pp. 469, 120, and 451. It is in the Michigan Bluff District, comprising an area of 704.56 acres, through which the "white" channel of the divide passes. At the point of present working the channel is known to be 1,300 ft. wide from rim to rim. The volcanic capping reaches a depth of 650 ft., with 150 ft. of underlying gravel. The elevation at the top of the deposit is 4,550 ft., and the underlying bedrock 3,700 ft. above the sea-level; while Blacksmith's Ravine adjoining is about 2,900 ft.

The bedrock is a soft, swelling slate, which is one of the main considerations in the working expenses of the mine. The main tunnels have the timber sets 2 ft. apart, using 8 ft. posts and 5 ft. 4 in. caps, in the clear, with a 12 ft. spread, no mudsills being used, and extremely heavy "T" rails for the track, 30 lbs. to the foot. The tunnels are closely lagged. If left to themselves, these tunnels entirely fill up in two years, twisting and breaking the heaviest timbers. The channel drifts are carried 100 ft. wide, the ground divided into 200 ft. blocks, and half worked from either side diagonally; later, commencing at the back, the

pillars are removed. The gravel drifts are carried 6 ft. high, timbered with posts and caps, the latter joining. Breast boards and false sets have to be used with breasting gravel, and the lagging has to be kept driven up close. Notwithstanding these precautions occasional parcels of the ground are lost. Three hundred carloads of gravel, each 1 ton in weight, are extracted per day, said to have averaged $1 35 per car during the previous season. The timber account of the mine varies from $750 to $1,000 per month, at a cost of $5 per 1,000 ft., running measure. One hundred inches of water is used for washing, under a 20 ft. head. Up to date 1,000 ft. of channel has been worked. A total of 126 men are employed; of these 88 are Chinese. In washing the gravel the first few boxes are cleaned up every day, the following 1,400 ft. of flume once a month, and all below that once a year. For the present the mine has let a timber contract for 1,712,133 ft. of mining timbers, including lagging. H. T. Powers et al., of Sunny South, owners.

Lady Bedford Mine (Quartz).—This property is 7 miles S.E. from Westville, and 10 miles E. of Michigan Bluff. The vein courses N. and S., dipping 50° E., with an average width of 8 ft., between a slate foot-wall and a porphyry hanging-wall. The quartz is of ribbon structure, carrying 1 per cent of iron pyrites with some galena. The croppings, which are quite prominent, can be traced for 1 mile. The developments are a 30 ft. tunnel running north, with an upraise of 60 ft., which cuts a 6 ft. vein. A 2-stamp mill, with 250 lb. stamps, crushes nearly a ton of quartz in twenty-four hours, using a No. 30 perforated screen; the apron is 8 ft. long. Page et al., of Michigan Bluff, owners.

Live Oak Claim (Drift).—See our VIIIth Report, p. 474.

Manhattan Mine (Drift).—See Weske Mine.

Mammoth Bar Mine (Placer).—Is on the North Fork of the American River, 5 miles from Auburn, and embraces 10,000 ft. along the river. The gravel is worked by hydraulic elevation. See our Xth Report, p. 417. Col. Davis, of Auburn, owner.

Marguerite Mine (Quartz).—This property is half a mile from Auburn. The claim contains 1,500 ft. on the course of the vein under an agricultural patent. The vein runs N.W., dipping 73° W., with a width of 2½ to 5 ft., between walls of serpentine. The quartz carries 7 per cent of sulphurets, iron, chalcopyrite, and galena, and is of glassy texture. The present workings consist of an incline shaft 115 ft. deep, double-compartment, 5 by 9 ft. in the clear. Eighty gallons of water are hoisted per day with a horse-whim. A 9 in. blower produces the ventilation, being run by a 1½ horse-power steam engine. After further development, a mill and chlorination works are to be erected. G. F. Deetken, of Auburn, owner.

Mayflower Gravel Mine (Drift).—This claim was described in our IXth and Xth Reports, pp. 120 and 453, and comprises 1,400 acres in parts of Secs. 22 to 27, inclusive, as also parts of Secs. 14 and 15, in T. 14 N., R. 10 E. The mine is situated 3 miles N. of Forest Hill. Up to date there have been worked 3 miles of the lower channel and 2,000 ft. on the Orono channel. With 34 men on the shift, the present output is 80 carloads of 1¼ tons per shift; two shifts are employed. The water supply is obtained from Shirt-tail and Blackhawk cañons, through 12 miles of ditch, and is delivered under a head of 340 ft. The water season lasts from November to July. The company is supplied with an Ingersoll boring outfit, which is used in prospecting and locating the course of the

channel through their property, finding the depth to bedrock, a
ting down holes for ventilation. Mayflower Gravel Mine, owner
Jones, of Forest Hill, Superintendent.

Morning Star Mine (Drift).—This property, described in our V
IXth, and Xth Reports, pp. 472, 111, and 420, is in Indian Cañon
a mile from Iowa Hill, at an elevation of 2,644 ft. The present o
of gravel is 75 carloads, of 1 ton each, said to yield an averag
$7 50 per ton, the gold being worth over $18 per ounce. Forty men
employed. Over 1,000 ft. of the channel has been worked. Morr
Star Mining Company, owners; J. H. Neff, of Colfax, President
Superintendent.

Mountain Gate Mine (Drift).—See our VIIIth Report, p. 468.

Old Pacific Mine (Quartz).—This is the west extension of the Go
Blossom Mine, and controls 1,000 ft. in length on the vein, which cours
E. and W., dipping to the S. The vein is 18 in. wide, and severa
shafts, ranging from 40 to 90 ft., have been sunk. The ore extracte
was all shipped. Dr. M. Schnabel et al., of Newcastle, owners.

Osborne Mine (Quartz).—This is 4 miles S.E. of Westville, and con
trols 1,500 by 600 ft. on a N. and S. vein, 8 ft. wide, dipping 80° E.,
between slate walls. The developments consist of a tunnel on the ledge,
300 ft. long, and an 83 ft. shaft.

Paragon Mine (Drift).—See Breece & Wheeler.

Pioneer and Lynn Mines (Quartz).—This property is in the Towles
District, 2 miles W. of Damascus. There are eleven locations included
in the property, each 1,500 by 600 ft., on several veins. The course of
the vein is slightly to the E. of N., and dip 80° E. The country rock is
slate, with a porphyry foot-wall. There are four different tunnels open-
ing on the veins; the upper one 300, the second 200, the third 400, and
the fourth 1,400 ft. in length. The latter is the main working tunnel,
5 by 6½ ft., and cost $10 per foot. Little timbering is necessary.
The main pay shoot on the Lynn vein is opened for a length of 400
ft.; it pitches S., and has been stoped on the entire length. About 10 in.
of water issues from the tunnel. The ventilation is supplied through a
520 ft. shaft, connecting with the lower tunnel. A No. 2 Baker blowe
is provided for special occasions.

The ore is trammed in 1-ton cars by hand to large bins on the surfac
situated at the head of an incline tramway, which is 2,700 ft. lon
with a changing slope, and leads direct to the mill, 1,100 ft. perpendic
larly below. The two cars on the incline carry 2 tons each, the full dow
car bringing the empty one up.

The ore carries a small percentage of sulphurets, with occasio
bunches of arsenical pyrites. The mill contains a double grizzly of
bars, 12 ft. long, 3 in. apart, ½ in. wide, set at an angle of 45°, lead
to a Blake crusher. The usual Hendy self-feeder operates from
center stamp. The 20 stamps, weighing 750 lbs. each, drop 90 ti
per minute, with a 5 in. drop, and discharge through a No. 30 s
punched screen, set with a slight inclination. The water is applied both inside
have an average life of 90 days. The battery has an inside plating consists of an apron
outside the battery. The outside plating, all set on a grade of 1½ in. to
the lip of the mortar. The outside sluice plates, and the batteries cleaned
long, and 12 ft. of 18 in. sluice plates are scraped every day, and the sulphurets are ship
foot. The plates are scraped every
a month. Below are 8 Frue concentrators.

The motive power is water derived from Damascus and Quartz cañons, conducted through 2 miles of ditch. Thirty inches of water is delivered through an 11 in. pipe, under 600 ft. pressure, on three Knight wheels of 3 ft. diameter each.

The company have had to build 6 miles of graded road at a great expense. Thirty men are employed; miners get $3, millmen $2, and Chinese $1 75 per day. J. G. Fair et al., of San Francisco, owners.

Rising Sun Mine (Quartz).—See our VIIIth Report, p. 462. S. D. Valentine et al., of San Francisco, owners.

Salsic (*Smith & Fulweiler*) *Mine* (Quartz).—This property is half a mile N.W. of Auburn. The present works are on a vein coursing N. 45° W., and dipping 75° E. An incline is being sunk on a vein 1 ft. wide, between slate walls. The quartz is glassy, with a small percentage of iron sulphurets and some galena; the rock shows free gold in some places. Two men are at work, using a windlass. Smith & Fulweiler, of Auburn, owners.

Sellier Mine (Quartz).—This is 1½ miles E. of Forest Hill, in the Bath District, and controls 5½ acres of patented ground. The vein courses E. and W. and dips N. nearly vertical, between slate walls, and has an average width of 2 ft. A tunnel is being started to cut the vein at about 120 ft. in depth. Former works show a shaft 84 ft. deep, with a 4 ft. vein in the bottom. Sellier & Son, of Bath, owners.

Small Hope Mine (Drift).—This property is in Brushy Cañon No. 2, about 3½ miles N. of Forest Hill, and contains 40 acres. A prospect tunnel is started from the cañon and runs 2,000 ft. in slate bedrock. Next above the bedrock is 5 ft. of cemented gravel that carries a good grade of pay, while above it is a pay streak of gravel of lower grade. A spring-pole stamp and hand mortar are used to break up the cement, which is then washed through four sluice-boxes with slat riffles. W. D. Craneage et al., of Forest Hill, owners.

Southern Cross Mine (Quartz).—This property is situated on the bank of the American River, about 3 miles N.W. from the Pioneer Mine, and consists of two claims 3,000 by 600 ft. The vein courses N. 12° W., and dips 62° E. The veins are designated as the East, Middle, and West veins, and their respective widths are 40 in., 5 ft., and 2½ ft., with a distance of 175 ft. between E. and W. veins; the walls are slate. Two tunnels have been started to develop the E. and W. veins; that on the latter starts 30 ft. above the river and has been driven 25 ft. The tunnel on the E. vein is about 400 ft. above the river, and has attained a length of 40 ft. The former tunnel is intended to be the main working tunnel, from which cross-cuts will be driven to intersect the others. The croppings on the E. vein show pay ore for 400 ft. The quartz carries a large percentage of arsenical pyrites, and shows considerable free gold in spots. A 20-stamp mill is in process of construction, which is to be run by water power obtained from the river. Fourteen men are employed. C. L. Ford et al., of Towles Station, owners.

St. Lawrence Mine (Quartz).—See our VIIIth Report, p. 461. It is 3 miles N.W. of Newcastle, in the Ophir District, at an elevation of 650 ft. above the sea, and comprises 1,300 by 600 ft. on an E. and W. vein, 20 in. wide, and with a dip of 35° E. The walls are grano-diorite. The quartz is glassy, and contains about 4 per cent of sulphides of iron, lead, and antimony. The bullion is from .650 to .700 fine. The developments consist of a shaft and two tunnels. The shaft is intersected at a depth

of 171 ft. by the upper, and at 300 ft. by the lower tunnel. Two ore shoots pitching east are being developed, one 180 ft., and the length of the second not yet determined, though 100 ft. long to date. Only a few timbers are required in the mine; they cost 2½ cents per running foot, delivered.

The mill contains a Brodie rockbreaker with 18 in. jaws, a set of Cornish rollers, Hendy self-feeder, and a 3½ ft. Huntington mill. The apron plate is 4 by 11 ft., beneath which is a double mercury trap and a Johnston concentrator, which handles 9 tons in twenty-four hours. Below the concentrators are a Wheeler pan and two settlers. The sulphurets are shipped to San Francisco. Twelve men are employed. Col. C. F. Reed, of Ophir, owner.

Weske (Manhattan) Mine (Drift).—This claim was described in our Xth Report, p. 442. It is 1½ miles N.E. of Forest Hill. When visited preparations for reopening the property were being made, it having been idle for some time. — Weske, of Michigan Bluff, owner.

PLUMAS COUNTY.

The old gravel channels are one of the main reserves of California, and Plumas County will long figure as a prominent gold producer, as many of the known channels that have yielded so much wealth in the adjoining counties appear to have their source within her boundaries, and a great deal of unexplored ground is awaiting the advent of capital. But it is not alone as a gold producer that the mineral reputation of this county will be sustained. It can take a front rank with the other mineral counties of the State in the production of silver, copper, iron, and zinc ores, as soon as railroad transportation is afforded. The timber resources all through the county are vast and of superior quality, and available water power of the best kind is abundant, so that the natural facilities in connection with the mines are favorable for the development of the mineral wealth of the county.

Altoona Gold Mine (Quartz).—Described in our Xth Report, p. 472, and is between Round Valley and Crescent Mills. During the past season the drifts have been extended along the vein.

Alturas Mine (Placer).—A tailings claim on Slate Creek. See our XIth Report, p. 332.

Bear Mine (Quartz).—This property is 14 miles from Prattville. The vein is 5 ft. wide; course N.W., dip N.E. The walls are slate. F. C. Mandeville, of Butte Valley, Superintendent.

Beckwith Consolidated Gold Mine (Drift).—This claim is 7 miles S.W. from Johnstown, in T. 22 N., R. 11 E., and comprises 500 acres, but is undeveloped. A tunnel run into the ridge from the east has caved. E. McNeil et al., of Beckwith, owners.

Blind Lead Gold Mine (Quartz).—See our Xth Report, p. 475. An upraise of 20 feet has been made from the lower tunnel into the vein, which is now being stoped. These stopes have to be very substantially timbered with square sets and lagged overhead. The quartz carries cubical sulphurets and are not saved. The 10-stamp mill, run by steam, receives the ore direct from the mine, and employs battery amalgamation with apron plates alone. D. McIntyre, of Greenville, owner.

Brandt Gold Mine (Quartz).—This property is in Genesee Valley, in the slate belt, and has lately changed owners, who are erecting a

10-stamp mill with concentrators, and making other improvements previous to starting up the mine. Brandt Gold Mining Company, owners; G. Brandt, of Genesee Valley, Superintendent.

Bushman & Orr (Blackhawk) Mine (Quartz).—It is in Blackhawk Ravine. See our XIth Report, p. 328. D. Bushman et al., of Quincy, owners.

Butterfly Mining Company (Quartz).—This property is situated in Seneca township, 5 miles N.W. from Quincy, in T. 24 N., R. 9 E. The vein is 3 ft. wide, and strikes N. Both walls are slate. Three tunnels, and a shaft about 100 ft. in depth, constitute the developments. C. Thompson et al., of Spanish Ranch, owners.

Cayot Mine (Quartz).—This property is near the southern boundary of Plumas County with Butte, in Goodman township, about 14 miles N. from Forbestown. The formation is granite, with very large crystals of mica. There are five locations, running N.E. and S.W. with the course of the veins, which dip about 70° N.W. The developments are on the most westerly vein. Two tunnels are driven about 20 ft. above each other, the lower running nearly W. and the upper S.W. At 30 ft. in the upper and 80 ft. in the lower tunnel a 5 ft. vein of quartz was cut, and a crushing of 200 tons of quartz is being taken from it. The quartz shows free gold and a good percentage of sulphurets, iron, copper, zinc, and lead. F. Cayot, of La Porte, owner.

Centennial Mine (Drift).—This property is on the North Fork of the Feather River, 10 miles S. of Prattville, in T. 26 N., R. 8 E. A prospect bedrock tunnel has been driven a distance of 250 ft., and gravel is showing on the top of the tunnel. J. S. Bransford, of Quincy, owner.

Centennial Mine (Drift).—Another mine with this name was described in our XIth Report, p. 325, and lies 4 miles N.W. from Quincy. But few developments have been made. Challen et al., of Spanish Ranch, owners.

Consignee Mine (Drift).—See our XIth Report, p. 330.

Crescent Mill and Mining Company (Quartz).—See our VIIIth and XIth Reports, pp. 481, 469, and 330. Their property is in Sec. 24, T. 26 N., R. 9 E. The present workings are confined to the 400 ft. level, all above the 200 ft. level being practically worked out; between the 200 and the 400 ft. levels the lode shows from 70 to 85 ft. wide, practically barren. The present work is entirely exploratory. Drifts have been run both E. and W. for several hundred feet, but nothing better than $2 per ton rock has been encountered. The drift makes considerable water—354 gallons per minute. Down to the 200 ft. level there was no distinct walls to the vein; below this, the trap walls are very decided, with a slight gouge on both sides. Sixteen stamps of the mill are run on custom work. Crescent Mill and Mining Company, owners; A. W. Whitney, of Crescent Mills, Superintendent.

Cub Mine (Quartz).—This property is in T. 23 N., R. 8 E., 14 miles S.E. from Prattville, and contains two claims, 3,000 by 600 ft. The vein is from 14 to 20 ft. wide, courses N.W. and dips S., between slate walls. A shaft 20 ft. deep and a tunnel 40 ft. long have been started on the vein. The quartz carries iron and arsenical pyrites. A 2 in. gouge in the foot-wall carries a large percentage of sulphurets. The Cub Mining Company, of Butte Valley, owners; F. C. Mandeville, Superintendent.

Diadem (Edman) Mine (Quartz).—See our Xth and XIth Reports, pp. 486 and 323. It is situated on Mumford Hill, 12 miles W. of Quincy.

Mr. Edman reports having discovered in the ores of this mine selenium and also wulfenite. He has also found in the fine sands of Gopher Hill, near Spanish Creek, platinum and osmium-iridium. Edman et al., of Meadow Valley, owners.

Drury and Pacific Gold Mine (Quartz).—See our Xth Report, p. 473. It is situated on the edge of Round Valley, 2 miles W. of Greenville, in T. 26 N., R. 9 E. The property comprises three claims and two large timber tracts, and also controls the Round Valley reservoir, which has an area of over 4,400 acres. The vein is a very large fissure filled with syenite, traversed by seams and veins of quartz. The course of the vein is N.E. A serpentine belt occurs about 600 ft. distant. The mine is worked through tunnels, the upper one being over 1,600 ft. long. On this level and from there to the surface the present ore supply is taken, which is hauled half a mile to the mill on the opposite side of the cañon. The lower tunnel, 250 ft. deeper, and extending 1,200 ft. into the hill, shows a better grade of ore. A new mill is to be erected below the mouth of this tunnel. The ore shoots in the fissure are short and change from one wall to the other No connection has been made between the two tunnels; the lower one is ventilated by a "water-blast" with 6 in. air pipes. Timbers last about five years in the mine and cost 3 cents each. The 20-stamp mill is closed during the winter, on account of the difficulty in hauling. G. Standard et al., of Greenville, owners.

Dubuque (Bell) Mine (Quartz).—See our Xth Report, p. 478.

Dutch Hill Mine (Drift).—This property was described in our VIIIth Report, p. 482, and is 7 miles from Prattville, at an altitude of 5,000 ft. During the past season a new bedrock tunnel has been run to the upper works on the channel, shortening the distance over which the gravel has to be trammed, from half a mile to 500 ft. From where the gravel was struck the tunnel was continued, quartering across the channel for 300 ft., the opposite rim not having been reached yet. This tunnel cost $4 50 per foot. The lava capping, as shown in the air shaft, is 325 ft. thick, and lies directly on the gravel without any pipe-clay intervening. The gravel wash consists of greenstone, red jasper, and quartz, with occasional lava bowlders. The pay is all within 4 in. of the bedrock, and is best where the ground has the most bowlders. One foot of the bedrock is picked up in cleaning. The pay streak runs irregularly in the gravel, which is slightly cemented, and a "breaster" can take out 5 tons or carloads per shift. The gangways are carried with 4½ ft. posts and the breasts are 35 ft. wide; single posts and caps are used. Ventilation is secured through an air shaft. There is a flow of 20 in. of water, which is used for washing; the dump holds 25 carloads. Washing is done twice a day, and the first cross-riffles are cleaned up every twenty-four hours. There are three lines of sluices, 12 by 14 in., with two intermediate drops of 5 and 10 ft., and a tailings reservoir. The boxes are cleaned up every three months and the tailings sold and rewashed every two years; the last washing yielded $400 net. Dutch Hill Mining Company, owners; W. Savercool, of Butte Valley, Superintendent.

Elizabethtown Gravel Channel Mining Company (Drift).—See our Xth Report, p. 478.

Emigrant Mine (Drift).—This property is about 2½ miles N. of Quincy, and comprises 80 acres, of which 5 acres have been worked. Course of channel, E. and W. Developments consist of a 70 ft. shaft and 45 ft. of drift; also an open cut with the bank from 6 to 100 ft. in depth. The

gravel, dark blue, is from 6 to 8 ft. deep. The breasts are carried 20 ft. wide and the drifts 4 ft. high. R. L. Bell, of Quincy, owner.

Fall River Consolidated Mine (Quartz).—This property is on Fall River, half a mile above the Plumas and Butte county line, and comprises 230 acres, including 160 acres of fine timber land; also a water power from Fall River with 90 ft. head, which can be increased to 115 ft. by running a new ditch. Two of the claims are patented; the remainder is held by possessory title. There are three veins, coursing N.E. in granite. Developments consist of two tunnels running N. of W. The upper one, 250 ft. long, crosses the front vein 30 ft. from the mouth, turns and runs S. on the vein 715 ft., showing 12 in. of quartz in the breast. After cutting the second vein the tunnel swings to the S. and follows an 18 in. vein of quartz. The lower tunnel, at the mill level, runs 950 ft. northwesterly, cutting the first vein 800 ft. from the mouth, where it turns both N. and S. on the vein, which is from 2½ to 5 ft. wide; the north drift is 250 ft. and the south drift 90 ft. long, exposing two short ore shoots. The tunnel was continued 60 ft. to the No. 2 vein, and a short distance beyond. No. 2 is 1 ft. wide where crossed. The quartz in these parallel veins carries about 3 per cent of sulphurets, iron, copper, zinc, and lead. The ore shoots pitch apparently to the S. About 5 in. of water issues from the tunnel. Ventilation is provided through an air shaft and water-blast, using 12 in. square wooden air boxes. The power of the mill is applied on a 5½ ft. Pelton wheel, with a 22 in. water pipe. The mill is supplied with a home-made self-feeder and one Frue concentrator. — Walters, of Gibsonville, owner.

Franklin Consolidated Gold Mine (Drift).—It is 5 miles W. of Poker Flat, and 9 miles S.W. from Johnstown. It contains 480 acres. It is a "white quartz" channel, and is supposed to have a N. and S. course, but has not been thoroughly developed yet. It carries a heavy wash, with coarse gold scattered through the entire depth of the gravel. The gold sells for $18 per ounce. Two tunnels have been run into the lava, both too high. The ground is well supplied with timber. D. McFarlan et al., of Beckwith, owners.

General Harrison Mine (Drift).—It is situated in Goodman township, 9½ miles from Gibsonville. It contains 40 acres of ground. No regular channel has been developed, the gravel being more in the nature of an outbreak or overflow from the McRae Ridge. The bedrock is slate; the capping cement and pipe-clay. The developments consist of a bedrock tunnel, 110 long; the gravel, 5 to 6 ft. deep, carries coarse gold. C. H. Radcovich, of Johnsville, owner.

Genesee Valley Mine (Quartz).—See our Xth Report, p. 476.

Glazier Mine (Drift).—See our Xth Report, p. 495.

Golden Reef Mine (Drift).—It is locally known as the Shores Ravine shaft, and is on Spanish Creek, 2 miles W. of Quincy. The company own 2 miles of the creek at its entrance into American Valley. A double-compartment shaft has been sunk to a depth of 66 ft., and a drift run S. 149 ft. across the course of the channel. At the distance of 117 ft. the tunnel cut through the rim into the gravel, but it was found to be too high. After reaching the south rim it is intended to run up channel till bedrock is struck. The plant consists of a steam hoisting works of 40 horse-power and a 12 in. jackhead pump, which raises about 5 in. of water. Agassiz & Shaw Company, of Boston, owners.

Green Mountain Mine (Quartz).—This property was mentioned in our VIIIth and Xth Reports, pp. 479 and 471. Though one of the notable mines of the county, at present it is working but a small crew of men, and only 25 stamps of the 60 are dropping. J. Goodwin et al., of Quincy, owners.

Hallsted Mine (Quartz).—See our XIth Report, p. 326. J. Hallsted, of Spanish Ranch, owner.

Hibernia (*Pennsylvania*) *Mine* (Quartz).—This property is 2 miles S.W. from Greenville, and is patented. The vein courses N.W. in syenite walls, and is from 5 to 12 ft. wide. An interesting feature of this property is that for the last twenty-five years the hillside facing the valley and below the vein has been slowly moving down to the valley; the cause of this movement has never been determined. See our Xth Report, p. 473. J. O'Toole, of Greenville, owner.

Indian Valley Mine (Quartz).—See our Xth Report, p. 472.

Jamison Mine (Quartz).—This property is on little Jamison Creek, in Secs. 25 and 26, T. 22 N., R. 11 E., and contains 500 acres, partly quartz and partly placer ground. It has an extensive water system, consisting of several lakes that overflow into one situated on the mountain overlooking the works, which are three fourths of a mile S.E. from Johnsville. The formation is diorite, carrying a series of quartz veins of varying width, mostly with a flat pitch of about 15°; the narrower the seams, the richer the quartz. The mine is opened by a shaft 160 ft. deep, connecting in the bottom with a drain tunnel 1,800 ft. long, which discharges into the Little Jamison Creek. The shaft has three compartments, 5 by 6 ft. in the clear. Machine drills are used. There are 3,000 ft. of 2 in. air pipes used in the mine. The power is derived from two 6 ft. Pelton wheels working under 460 ft. pressure. Tests of the ore made in the Plumas-Eureka mill show that a large proportion of the quartz is high grade. Thirty-five men are employed. Jamison Gold Mining Company, owners; S. Cheney, of Johnsville, Superintendent.

John Bull Gold Mine (Quartz).—This is in North Cañon, near Greenville. The claim, though 1,500 by 600 ft., has not been taken up on the course of the vein; consequently only 450 ft. of the vein belongs to the mine. Two other claims, known as the *Long Tom* and the *Phœnix*, belong to the same parties and adjoin the John Bull. The course of the John Bull is about S. 52° W., dip about 60° N.; the course of the Phœnix is N. and S., with a vertical dip. The width of the former is 20 ft. and of the latter 1 ft. The developments of the John Bull consist of two tunnels starting from the bed of North Cañon and about 50 ft. apart. The lower cross-cuts for 280 ft. and turns on the vein 200 ft.; the upper follows in on the vein 250 ft. Both are connected through stopes, and 70 ft. in length and 50 ft. in height of the vein has been stoped above the upper tunnel. The tunnel on the Phœnix extends 400 ft. on the vein, and some stoping has been done both above and below the tunnel level. The 5-stamp mill is run by a hurdy wheel with 100 ft. pressure. Cost of water, $3 for twenty-four hours. S. Firmstone et al., of Greenville, owners.

Kings Gravel Mine (Drift).—This property is on the North Fork of Feather River, 12 miles S. from Prattville, and embraces 90 acres. A tunnel runs N.W. in slate bedrock 300 ft., which strikes the bottom of the channel and is continued across about 200 ft. No breasting has been done yet. The gravel is similar to the present river wash, but is

slightly cemented and lava-capped, but has no pipe-clay. Ventilation is secured by a "water-blast" and 6 in. air pipes. Thirty carloads of gravel is the present output; this is washed once a day. The gravel is taken out 4 ft. high. Fred Scott et al., of Greenville, owners.

Long Tom Mine (Quartz).—See John Bull Mine.

Lucky S. Mine (Quartz).—See our Xth Report, p. 467.

Megown Mine (Quartz).—See our Xth and XIth Reports, pp. 484 and 324.

Mountain Chief Mine (Quartz).—This is on the west branch of Mill Creek, 4 miles S.E. from Quincy. The claim is 1,500 by 600 ft., on a belt of clay and quartzose slates, interspersed with quartz seams varying from a few inches to several feet in thickness. These seams bear a little W. of N., ranging with the formation, and dipping about 55° W. The property is being opened 225 ft. above the level of the creek, where a shaft has been started. On the creek is a 12 ft. arrastra, with horizontal wheel, using 4 tons of drag rock, having a capacity of 4 tons in twenty-four hours. The entire 4 tons are put in at once and ground for twenty-four hours. Plates are used with good results. The quartz carries some sulphurets. Timber and water are plentiful. G. Ellis, of Quincy, owner.

New Jersey Claim (Drift).—It is 11 miles N. of Gibsonville, on Nelson Creek. The property consists of 240 acres on the north end of Blue Mountain. A tunnel has been run 240 ft. in pipe-clay, and a shaft sunk 88 ft., showing 50 ft. of gravel; then 9 ft. of pipe-clay, followed by 12 ft. of gravel, and below that again pipe-clay. In the upper 50 ft. of gravel, there are 15 ft. carrying very large bowlders. Each separate layer of gravel contains gold in paying quantities. This channel is supposed to be a part of the Bunker Hill or Gibsonville channel, though some refer it to the Monte Cristo channel. It carries white quartz gravel, iron-stained for a short distance below the cement. Ventilation is produced through an 8 in. pipe in the shaft, with coal-oil lamp burning below it. Thomas Chapman, of Gibsonville, owner.

'93 Quartz Mine (Quartz).—This is near the Sulphur Creek ranch, 5 miles from Mohawk, and comprises 1,500 by 600 ft. The 3 ft. vein courses N. and S. and dips about 60° E. The foot-wall is slate, the hanging-wall a soft rotten rock. The prospect shaft is 80 ft. deep. A water power of 500 in. and 30 to 40 ft. fall can be had by half a mile of ditch from the mine. Timber is plentiful.

Ohio Mine (Placer).—This is 6 miles S.E. from Mohawk, and contains 120 acres. The gravel bank, which is just being opened, has a depth varying from 2 to 15 ft. of free gravel, containing considerable large bowlders, on a slate bedrock. Snow water, lasting three months, constitutes the water supply; it is retained in a small reservoir. The gold, worth $19 50 per ounce, is both coarse and fine; the former usually adhering to quartz. Eight boxes 3 ft. wide, set on a grade of 1 in. to the foot, and paved with block and rock riffles, are used for washing; an undercurrent 6 ft. wide is to be put in later. The quicksilver is scattered over the ground before the washing commences, and the clean-up is made at the end of the season. J. C. Knickrem et al., of Mohawk, owners.

Phœnix Mine (Quartz).—See John Bull Mine.

Pilot Hill Gold Mine (Quartz).—This property is situated at the foot of Pilot Hill, 6 miles N.W. from Gibsonville, at the head of Onion Val-

ley, at an elevation of about 7,000 ft. The property includes six claims, with two veins running nearly parallel and about 600 ft. apart, coursing nearly N. and S. and pitching toward each other. The average width is 5 ft. Several feeders make into the same veins, and these are heavily mineralized, carrying large bunches of arsenical pyrites, said to assay very high. The abruptness of the mountain side facing Poorman's Creek gives excellent opportunities for tunneling to the vein. Several tunnels have been started from this side. P. F. Turner et al., of Gibsonville, owners.

Plumas-Eureka Mine (Quartz).—This property was described in our VIIIth Report, p. 476, and is near Johnstown. The present workings are now confined to near the summit of the peak, in what is known as the "76" ground. Only 30 of the 60 stamps were dropping, and the present working force is 130 men. Plumas-Eureka Gold Mining Company, owners; T. Jenkins, of Johnsville, Superintendent.

Plumas Imperial Gold Mining Company's Mine (Hydraulic).—It comprises 900 acres of ground, on Hungarian Hill, 4½ miles S.W. from Quincy, and 300 acres on Emigrant Hill, 2 miles N. of Quincy; the latter ground includes three quartz ledges. The present operations are confined to the gravel deposit near Hungarian Hill, at what is known as the Five Points, where there is a gravel bank of 102 ft., capped by soil and some pipe-clay strata. Near the slate bedrock the bottom is covered with heavy bowlders. The upper portion is small gravel, and belongs to the youngest of the three gravel deposits that are found throughout this section of country. The present pit extends about 200 ft. and is 102 ft. deep. The supply of water is obtained from Deer and Rock creeks and their tributaries, through two series of ditches, 6 and 9 miles in length, giving a pressure of 380 ft., although under the present operations only 250 ft. of pressure is used. A 5,000 ft. pipe-line of No. 14 iron conveys the water to the "giants," reducing from 22 in. to 15 in., and throwing the stream through 7 in. and 4 in. nozzles. The ditches have a capacity of 1,200 in.; the water season lasts ten months. Two sets of flumes are used, 4 and 3 ft. in width, paved with block and rock riffles. The dump is into Rock Creek, where a restraining dam has been built 30 ft. wide at the base, 17 ft. on top, and 20 ft. high, of solid rock, half a mile below the present pit. The gravel prospects throughout its entire depth, but is richest on the lower 6 ft. The gold sells for $18 per ounce. Timber of fine quality is on the ground, and a sawmill is within 2½ miles of the property. Plumas Imperial Gold Mining Company, owners; Col. Day, of Quincy, Manager.

Quincy Mining and Water Company (Hydraulic).—This claim is on Gopher and Shores Hill, on the north bank of Spanish Creek, 6 miles W. of Quincy, and comprises 2,200 acres. The channel, which courses E. and W., belongs to a period later than the main lava flow, and is worked about 400 ft. wide. The present bank (110 ft. high) is capped with pipe-clay, strata of which are found also in the gravel. The gold in the upper courses is not as coarse as that below the bottom strata of pipe-clay; it is all valued at $19 50 per ounce. The source of water supply is Spanish Creek and its tributaries, Bean Creek, Little Bean Creek, also Gold and Silver Lake on Spanish Peak. They use 1,400 in. of water, delivered from the ditches under a pressure of 350 ft., using 6,000 ft. of pipe, No. 14 iron, reducing from 22 in. to 15 in., and ejected from two giants with 6 in. and 7 in. nozzles. There are 2,500 ft. of 4 ft.

sluices set on a 6 in. grade, besides 860 ft. of a bedrock flume on a 10 in. grade. Both are paved with rocks, and supplied with quicksilver. A clean-up of the head boxes is made every twenty days. The company employs 24 men at wages varying from $1 50 to $1 75 per day with board. Quincy Mining and Water Company, owners; W. C. Ralston, of San Francisco, Secretary.

Salmon Falls Mine (Drift).—This property is in Seneca township, and is S.E. from Prattville; it comprises 100 acres on the North Fork of Feather River. A tunnel has been run 400 ft. in the trap-rock close to the falls to cut the Glazier channel, and is being continued. The lava capping at this point is about 400 ft. D. McIntyre et al., of Greenville, owners.

Savercool Mine (Quartz).—See our Xth Report, p. 493.

Shenandoah Mine (Quartz).—See our XIth Report, p. 324. The 10-stamp mill has been moved to the immediate proximity of the mine, and they are driving the main tunnel ahead, developing some very good ground. Capt. J. W. Smith et al., of Oakland, owners.

Specimen (*See and Seren*) *Mine* (Quartz).—See our Xth Report, p. 490.

Wildcat Mine (Drift).—This property is in T. 26 N., R. 8 E., 10 miles S. of Prattville. A tunnel has been started 3 ft. above the level of the North Fork of the Feather River, and run for 300 ft. The channel is 75 ft. wide, apparently a former bench of the present river. The pay is confined to the bedrock. Wildcat Drift Gravel Mining Company, owners; A. Cameron, of Prattville, Superintendent.

RIVERSIDE COUNTY.

This county, formed by an Act of the last Legislature from portions of San Bernardino and San Diego counties, has mining industries and mineral resources of great value. The complete equipment and operation of the Good Hope Mine, near Perris, has given a decided impetus to mining in all the region thereabouts, and several new prospects are being opened and old ones rehabilitated. The largest coal mine in the southern part of California is in this county, near Elsinore. Clay deposits and marble are also abundant and continue to be actively worked. In the extreme eastern part of the county, on the desert, new mines have recently been discovered, equipped, and are in successful operation.

An ancient river-bed may be traced for a long distance north and south in this county. The source of this old channel, which is gold-bearing, is to the north, but its exact locality is unknown. The indications are, however, that several small streams have united to form the main channel, which may be followed without difficulty from 2 miles N. of Good Hope for several miles in a southerly direction toward the town of Elsinore. Where the channel reaches the San Jacinto River it is several hundred feet in width, and upwards of 100 ft. in depth. In the cañon of the San Jacinto River may be seen either two or three channels, or else the remnants of one extremely crooked one. As these ancient river-beds are not at all developed, excepting by the shallow erosion of their upper portions by the recent little ravines and gulches, there is much that would be interesting concerning them, that for the present must remain unknown. Although no attempt has yet been

made to systematically work these deposits, or even to prospect them, beyond the sinking of several shafts, it is nevertheless a significant fact that every little ravine and gulch cutting through this old river-bed has contained gold, and in most instances has been worked by the Mexicans years ago. Signs of work in later years are also numerous, and at one point an old prospector was endeavoring to make a living by "rocking" the gravel of the old river channel. If sufficient water for hydraulic operations were obtainable the old river-bed might be found to produce a large quantity of gold. The channel was followed for about 5 miles, but it being evident that to trace it out and map it would require a season's work, it was abandoned for the time being.

Alice Mine (Quartz).—This is a new discovery 4 miles S. of Menifee P. O. It was opened to a depth of 10 or 12 ft. in several places, and a shaft was being sunk in the hanging-wall granite, which was calculated to reach the vein about 20 ft. from the surface. The only advantage in this shaft over one sunk directly on the vein was apparently in the fact that the country rock was much softer than the vein quartz, which was extremely hard and dense, having a fine granular texture. Wilson & Crane, of Winchester, owners.

Barker Mine (Quartz).—See Dos Palmas. C. O. Barker, of Banning, owner.

Charity Mine (Quartz).—See Free Coinage.

Colorado (Justice) Mine (Quartz).—This is 4 miles S. of W. from Perris. The vein is small, but the quartz is high grade. Knight et al., of Perris, owners.

Dos Palmas, Gold Prospects Near.—There is a group of gold mines on the Colorado Desert 18 miles N. of Dos Palmas Station, which was not visited by the field assistant, but which from descriptions by trustworthy persons may be looked upon as valuable prospects. The veins are of good size, fissures of strength, and ore of good grade. Water is obtainable within 6 miles of the mines, at a place called Cañon Spring. One of these claims is described as being located between two cañons 1,500 ft. apart. The crevice is 3 to 6 ft. wide, and the pay shoot 1 to 3 ft. Two tunnels, one of 90 and the other of 190 ft., have been driven in on the vein.

Fish Mine (Quartz).—It is in the Cañon Springs region, and the little work done shows a fine vein of gold-bearing rock.

Free Coinage and Charity Mines (Quartz).—These are two locations, made in 1893, about 5 miles N. of Cañon Springs, 12 miles N.E. of Dos Palmas. The vein in the Free Coinage has 28 in. of free-milling ore and a 6 in. vein of quartz, containing galena and carbonate of lead. This ore also contains some silver. E. E. Bowles, of San Diego, owner.

Gavilan Mine (Quartz).—This is owned by the San Jacinto Estate (limited), of London, and has been idle since the spring of 1892. See our XIth Report, pp. 366 and 368. Pedley Bros., of South Riverside P. O., agents.

Good Hope Mine (Quartz).—This is about 4½ miles S.W. of Perris. The mine has had quite an interesting history, being formerly owned and worked by Mexicans and subsequently by American owners. It is now the property of a Massachusetts corporation, and for the first time in its history is well equipped and being systematically developed. No. 1 level is 250 ft., No. 2, 350 ft., and No. 4, 450 ft. from the surface, the sump extending 35 ft. lower. The first and second levels are each 800

ft. in length, and the third 60 ft. long, and was being extended. The mine occurs in a gray, homogeneous, syenitic granite. Near the surface there are several veins at distances varying from 3 to 20 ft. apart. These, in depth, appear to unite, forming a somewhat irregular fissure with a branching tendency. The development of the mine thus far indicates that the offshoots pass into the foot-wall side. The fissure is at times poorly defined and again is clear, accompanied by a heavy clay seam, the result of long continued movement and the crushing of the rock immediately adjacent to the place of movement, into powder. The vein quartz itself also shows clearly the effect of this movement in a complete fracturing of the massive rock, and the subsequent infiltration of carbonate of lime into the small interstitial spaces thus formed. This renders a great deal of the quartz friable, it usually crumbling and slacking on exposure. The vein commonly appears as two separate bands of irregular size.

The fissure, it would seem, was what might be called a double fracture, a vein of quartz forming on each fissure plane. The foot-wall streak at some points contains a very high-grade ore, carrying finely disseminated iron sulphurets. The quartz is free milling, though ordinarily carrying more or less auriferous iron sulphuret of high grade. A very complete and exceptionally well-constructed 20-stamp mill has just been built and other surface improvements made. The mill contains 4 Frue vanners and 2 Johnston concentrators. Unfortunately during the unusually dry season of 1894 there was a scarcity of water, but this can be remedied by developing several springs in the neighborhood. A most encouraging feature in the Good Hope is the solid shape taken by the vein in the bottom. The quartz is well defined, the contact of granite and quartz is well marked, and never at any point where examined was it found "frozen." The indications are that the fissure is one of great depth and longitudinal extent, whatever character and value the quartz veins may be found to assume in the undeveloped portions of the mine. In June, 1894, there were employed in the mine and mill and in other surface work 65 men. There are two good shoots of ore, and these are being opened and blocked out as rapidly as possible. When the necessary information has been obtained concerning their pitch, etc., a new double-compartment working shaft will be sunk. The main working shaft, now having a total depth of 485 ft., has but one compartment.

Several hundred feet north from the main shaft a strong dike of dark-colored basic rock cuts the country, striking E. and W. At several points along its course this dike is shattered and crushed by movements which have taken place subsequent to its injection. At these points iron oxide appears and the rock is gold-bearing. The dike consists of two distinctly different rocks, and may be, in fact, two separate injections. One of these rocks is aphanitic, hard and black, resembling some diorites. The other variety is coarsely crystalline, resembling greatly some of the diabase of the "Mother Lode" region, and particularly that near Chinese Camp, in Tuolumne County. As at this writing no microscopic study has been made of either of these rocks, they are classed provisionally. The dike intersects the course of the vein, but whether the dike or the vein is the older is unknown. The underground workings of the mine have not penetrated as far north as the intersection of these two fissures, and the surface intersection is obscured by the ancient river-bed mentioned at the beginning of this chapter.

Good Hope Mining Company, owners; John M. S. Egan, of Perris, Superintendent. See our VIIIth, IXth, and XIth Reports, pp. 527, 151, and 106.

Hexahedron Mine (Quartz).—It is 7 miles N.E. of Piñon Mountain. The shoot of ore lies on the side of a hill. It is 75 ft. long, 15 to 20 ft. in thickness, and dips 45° N. The ore occurs as a mineralization of a felsitic dike, which strikes nearly E. and W. At the west end it is small (not over 4 ft.), but widens in going east. It passes from the south to the north side of the range of hills in which it occurs, and at the place where gold was found, lies exposed along the hillside, the overlying rocks having been eroded. Dikes of dark green diorite, much decomposed at the surface, have been thrust into the felsite and adjoining rocks in a very irregular manner, and in this vicinity the felsite contains gold. A small amount of iron oxide, copper carbonate, and dendritic infiltrations of manganese oxide are the only indications suggesting ore. The most ordinary rock, having nothing in its appearance to suggest that it is gold-bearing, is seen on closer inspection to be spangled with small points of gold. In the vicinity of the Hexahedron Mine are some small prospects, on which a few holes have been sunk. Ed. Holland and A. G. Tingman, of Indio, owners.

La Ploma Mine (Quartz).—See Victor.

Leon Mine (Quartz).—This is one of the latest discoveries. It is situated on the Briggs ranch, 4 miles E. of Menifee P. O. This section is about 14 miles S.E. of Perris. Where exposed, the quartz is from 1 to 2 ft. in thickness. A shaft has been sunk 50 ft. and a cross-cut tunnel run about 25 ft. toward the vein at a point lower down the hill. From a prospective standpoint it had a promising appearance. The rock prospects well, and occasionally the particles of gold are large enough to see with the unaided eye. Briggs Bros., of Leon, owners.

Little Maggie Mine (Quartz).—It is 3½ miles W. of Perris, on several small fissures in syenitic granite. The quartz found in this mine is high grade. It is crushed in an arrastra. A cross-cut tunnel to intersect the main fissure at a depth of 40 ft. was being run. There are numerous claims in this section, located on these little fissures in the granite, but none of them except this were being operated. J. M. Hasson, of Perris, owner.

Lost Horse Mine (Quartz).—It is 7 miles N. of Piñon Mountain, at an altitude of 5,000 ft. The vein strikes E. and W., and dips 85° N. It cuts through a formation striking N. and S., composed for most part of a laminated micaceous quartzite, of granular appearance. Occasional dike-like masses of granite also occur, but the vein cuts everything else. It is exposed at several points along its course for a distance of 800 ft. Its width is from 6 in. to 5 ft., and exhibits the overlapping tendency, the foot-wall becoming the hanging-wall of the next shoot below. The mine is worked by a small force, the rock being hauled 8 miles to the Piñon Mountain mill. With more abundant water and a mill having greater capacity, this property, which consists of two claims, should become a large producer. The mine is 19 miles N. and a little E. of Indio in a direct line, and about 28 miles by wagon road. Lang, Holland & Tingman, of Indio, owners.

Lucky Boy (Walker) Mine (Quartz).—It was discovered in the spring of 1892, but was idle during the summer of 1894, as considerable water was encountered in sinking, and the owners, being men of limited means,

make slow progress in the work of development. See our XIth Report, p. 385. Luke Walker, of Menifee, owner.

Monte Negras Mines (Quartz).—Very little has been done here since 1892. A few tons of ore were packed out and worked in the small stamp mill at Virginia Dale, but with what results was not learned. In most cases the assessment work had not been performed, and many of the claims have been relocated. See our XIth Report, p. 368.

O'Brien Mine (Quartz).—This is 1 mile W. of Good Hope Mine, and comprises 1,500 by 600 ft. Mrs. O'Brien, of Perris, owner.

Onward Mine (Quartz).—It is one of a group discovered recently on the Colorado Desert between Virginia Dale and the Colorado River, and about 45 miles S. of Danby Station, on the A. & P. R. R. The quartz is mostly very ferruginous, some of it jaspery, and usually oxidized and honeycombed, showing gold. The district is not a large one, comprising a group of isolated hills which rise out of the desert plain. Lum Gray & Bro., of Phœnix, Arizona, owners.

Piñon Mountain District.—The mines are in the desert about N. 30° E. from Indio 12 to 14 miles, at an altitude of about 5,000 ft. above the sea, Indio being nearly 200 ft. below sea-level. The several more prominent veins have a N.W. strike and a variable dip. They are all branching fissures of that peculiar type common to massive rocks such as granite. Often the fissures consist of a single slip, but more frequently two walls may be seen. These are not usually parallel for any considerable distance, but approach in strike and dip, and finally meet where the ore or gold-bearing material is "pinched" out, but it is generally found on the opposite side of one of the walls. As a rule, the foot-wall of any particular mass of ore becomes the hanging wall of the next shoot of ore beyond. When the pay rock disappears the granite begins to assume its normal appearance, becoming hard and crystalline, and no clearly defined wall is visible. It is usually observed that one side of the workings is softer than the other. In such a case the ore is found a little farther on by cross-cutting the soft side. Some very high-grade rock has been taken from the several claims of this group, which was crushed in a 2-stamp mill a mile from the mines. The deepest work on these veins is 70 ft. from the surface. Holland & Tingman, of Indio, owners.

Rosalia Mine (Quartz).—See Santa Rosa.

S. S. Mine (Quartz).—It is 4 miles S. of Virginia Dale, in the Monte Negras region, 55 miles N.E. of Walters Station, and is a new discovery, made during 1894. It has produced some very high-grade ore. T. B. Lyon, of San Bernardino, owner.

San Diego Mine (Quartz).—It is a new prospect in the Chuckawalla Mountains, 45 miles N.E. of Salton Station, and 4 miles from Long Tanks. The rock found here is high grade, heavily mineralized and oxidized. Water, though not abundant, occurs in the neighborhood, and the mining facilities are as good as are ever found in this portion of the desert. E. E. Bowles, of San Diego, owner.

Santa Fe Mine (Quartz).—It is 5 miles W. of Perris, and has been developed somewhat since our last report, but was not working in 1894, and the tunnels leading into the mine were locked. No data could be obtained about this property. See our VIIIth and XIth Reports, pp. 527 and 385. Phelps, Judson et al., of Pasadena, owners.

Santa Rosa (*Rosalia*) *Mine* (Quartz).—It is 7 miles W. of Perris, and has recently been reopened after a period of long idleness. Hoisting

and milling machinery has been purchased, and will be put in place before November 1, 1894. The new workings extend to a depth of 200 ft., and expose a 3 ft. vein of quartz of good grade. The mine has been worked to water level, and about 1,000 ft. along the vein, by Mexicans many years ago. See our VIIIth and XIth Reports, pp. 526 and 385. W. H. Griffith, of Perris, Superintendent.

Stanford Mine (Quartz).—This is 1 mile S.E. of the Victor. The mine is rather different from those commonly found in this district, being a system of branching and overlapping fissures in a massive eruptive rock. The veins or shoots occur irregularly, and are richest and best defined near the points of intersection of two fissures, or occur in vein-like masses between two nearly parallel fissures. At some points the shoots occur as a zone, being in the form of several vein-like deposits uniting or lying parallel. In such cases the entire mass is gold bearing, and may be mined with profit. The developments consist of a shaft 125 ft. deep, a cross-cut tunnel from the surface, intersecting the shaft at 70 ft., where a drift runs along the vein. A small 5-stamp mill has been erected just below the mine for prospecting purposes. Hearn Bros., of Perris, owners.

Stanford Mine, Small Prospects Near.—A number of small prospects are being opened near the Stanford Mine, one or two men being employed on each. The rock is taken to the Huntington mill, which treats custom ores. During the past season prospecting has been carried on through this section, resulting in the discovery of a number of small veins in granite. As a rule, these veins do not hold out in depth, but afford a temporary means of livelihood for the discoverer, and in some instances prove veritable small bonanzas.

Victor (*La Ploma*) *Mine* (Quartz).—This was idle during the past year. There is a cross-cut tunnel, mostly in hard rock, nearly 1,000 ft. in length. The quartz is hard and crystallized and frequently carries galena. Some of the rock is rich in gold, but the vein is spotted. In appearance it greatly resembles many of the "pocket" veins of Mariposa and Tuolumne counties. See our VIIIth and XIth Reports, pp. 527 and 384.

Virginia (*Shey*) *Mine* (Quartz).—It is 3 miles W. of Perris. Since our last report this property, then a prospect hole, has been bonded, and considerable development work done. The main shaft is down nearly 200 ft. See our VIIIth and XIth Reports, pp. 526 and 385. Jerry Shey, of Perris, owner.

SACRAMENTO COUNTY.

In Sacramento County placer and drift mining are carried on in the foothills of the Sierra, and in the slate formation there are a few pocket mines which are said to have yielded very rich ore. In 1878–79, experimental borings were made at Folsom, to prospect the auriferous strata underlying the tufa which constitutes the "bedrock" on which the superficial gold-bearing gravels rest. The formation penetrated by these borings is as follows:

Cobblestones	10′
Fine loose gravel, with water	6′
Tufa	15′
Auriferous white sand	5′
Quicksand (water raised in casing)	7′
Cemented gravel	5′
Loose sulphurets	3′
Auriferous and cemented gravel	50′

E. McCue & Co., bearing in mind the results of these early investigations, are sinking a shaft at Folsom to further prospect the auriferous sands and gravels beneath what was formerly considered to be the "bedrock." Dredging has also been commenced in the bed of the American River at Natoma.

Amador and Sacramento Canal Company's Mines (Placer).—These mines are on the south side of the Cosumnes River, at Michigan Bar. They cover an area of about 1,800 acres, and are for the most part situated on patented land. The Columbian Gold Mining Company work the placer claims on the property by hydraulic mining and ground-sluicing. Ten men at work. See Ritter Ditch, under title of Cosumnes Land and Water Company, in our Xth Report, p. 514.

Burke Mine (Drift).—It is at Rebel Hill, 3 miles S.W. of Folsom, on the Natoma Grant. The shallow shaft penetrates gravel, clay, and cobblestones for about 55 ft., at which depth there is a stratum of auriferous gravel about 4½ ft. in thickness, which rests on a bedrock of tufa. The gold is flaky and rusty. Seven men at work.

Chinese Claims (Drift).—About 25 Chinamen are engaged in drift mining in the town of Folsom.

Doc Yen Mine (Placer).—This claim, on the Natoma Grant, is worked by 13 Chinamen, and is a deep gravel claim; worked by stripping to a depth of 33 ft.

Doan Mining Dredger.—In July, 1894, the owners of this machine commenced dredging the bed of the American River at Natoma. Their plant consists of a grab-dredger run by steam power, and having a normal capacity of 500 tons every twenty-four hours; also two 10-inch pumps. The gravel is dumped by the grabber into a 4 by 6 ft. hopper, which is furnished with a screen perforated with 1 in. holes. The coarse gravel is washed from the screen into the river. The fine gravel and sand pass through the screen into sluices, which are provided with riffles and blankets. The scow on which the dredger is erected is 18 by 30 ft. Three men are employed.

Dorian Mine (Quartz).—This claim is on patented land, in Sec. 4, T. 8 N., R. 8 E., in the Wall Town Mining District. P. Dorian, of Folsom, owner.

Eckardt Mine (Placer).—It is 5 miles E. of Folsom, in Willow Springs District, covers an area of about 20 acres, and is on the Natoma Grant. Eight men at work.

Eckhardt Mine (Quartz).—This mine is in Willow Springs Mining District. It is a pocket mine. P. D. Eckhardt, of Folsom, owner.

Finch Mine (Drift).—This claim is at Rebel Hill, on the Natoma Grant. Three men at work.

Folsom Water Power Company's Mining Claim.—This is situated in the bed of the American River, and, commencing at the dam above the Folsom State Prison, it extends for a distance of about 2 miles down the stream. The officers of this company state that they contemplate turning the water from a portion of the bed of the American River and mining its channel.

Jordan Mine (Placer).—This mine is on the north bank of the Cosumnes River, and covers an area of 160 acres. The claim is worked by ground-sluicing. Six men at work. Jas. Jordan, of Michigan Bar, owner.

Keefe & Mahone Mine (Placer).—It is on the Natoma Grant, in Willow Springs District, 5 miles E. of Folsom. Five men at work.

Milgate Mine (Quartz).—It is on patented land in Wall Town Mining District. This is a pocket mine, which yielded a small amount of very rich ore several years ago. W. Milgate et al., of Sacramento, owners.

McCue & Co.'s Mine (Drift).—E. McCue and others are sinking a 4 by 8 ft. shaft to prospect sands and gravels which were worked at an early day at Folsom. In June, 1894, the following formation had been penetrated: Tufa, 53 ft.; auriferous sand, 2 ft. Three men at work McCue & Co., of Folsom, owners.

Old De Rosa Mine (Placer).—It is on the Natoma Grant, at Sulky Flat. Four men at work.

Perry Mine (Drift).—It is on the Natoma Grant, in Willow Springs District, 5 miles E. of Folsom. Six men are employed.

Rodger's, Antone, Mine (Placer).—At Sulky Flat, on the Natoma Grant. Four men at work.

White & Donelly Mine (Drift).—This claim is on the railroad right of way at Folsom. The developments consist of two 45 ft. shafts and many feet of drifts and cross-cuts. From 20 to 25 men are employed. White & Donelly, of Folsom, lessees.

Zimmerman Mine (Quartz).—This is situated on patented land about 5 miles S.E. from Folsom. The developments consist of a 30 ft. shaft.

SAN BENITO COUNTY.

Chalone and Defiance Mines (Quartz).—These mines are situated on a ridge running N.E. from the South Chalone Peak, at an elevation of 2,200 ft. They are reached by a trail nearly 3 miles long from the lower end of Bear Valley. Gold occurs here in a very unusual manner, seeming to be an original constituent of a body of fine-grained, white liparite. This liparite is found in the center of a much larger area of banded liparite, obsidian, and tufas, which forms the Chalone Peaks and the mountains northward for 6 miles or more, with a width of about 2½ miles. The body of gold-bearing liparite has an irregular wedge form with its point to the north. On its southern extremity it is about a mile across. The two claims located here are one fourth of a mile apart, on deposits which are apparently wholly independent of each other. No work has yet been done on the Defiance, but on the Chalone, which lies on the north side of the ridge, a tunnel has been run 290 ft. The end of the tunnel will be nearly 400 ft. from the surface when the center of the hill is reached.

A careful examination of the liparite shows it to be uniformly fine-grained and almost white, except where stained with iron. It varies somewhat in texture, portions being very compact, while others are more loose and porous, the spaces not being gas pores, but those left by contraction on cooling. It is very difficult, if not impossible, to distinguish the gold-bearing rock from that in which the mineral has not been detected. In some places where the gold is found the rock is more porous, but this is not always the case. A small amount of manganese is found coating the seams in some places on the surface of the Chalone claim. This was not noticed in the tunnel. None of the many assays made from the material taken out of the tunnel have failed to show

traces of gold. There are no indications of a fissure or crushed zone, and it is difficult to account for the presence of the gold if it is not primary. Many specimens have been found in which the gold is plainly to be seen with the unaided eye. It sometimes occurs on the borders of small cavities with oxide of iron, probably resulting from the decay of iron pyrites, and at others in the white rock. A very little water seeps into the tunnel in places, not more than to make it moist, and though the rock is full of joints, so that it breaks up into small fragments, yet this feature is no more noticeable than in other portions where no traces of gold have been found. The round blotches of iron oxide are to be found over almost the whole area of the white liparite. They are an eighth of an inch or less in diameter, and result from the decay of iron pyrites, the cubical form of which sometimes remains. It was at first supposed that the gold might have been originally combined with the pyrites, but that this was not generally so, is shown by the results of assays made on several portions of the white liparite where the brown stains are the most numerous; no appreciable amount of gold being found. The Chalone claim has a N. and S. course, extending up to the summit of the hill rising from the ridge. Captain Nichols, who is in charge of the work, reports that gold has been found the whole length of the claim, with a greatest width of 200 ft. The area in which gold has been detected on the Defiance claim is said to be quite irregular. Several assays made from the white liparite on the southern and eastern sides of the hill also show traces of gold, proving conclusively its wide distribution. The results of these observations seem to indicate without much doubt that the gold is distributed very generally through the white liparite, though not evenly, and not always in quantities which can be detected with the methods used. The absence of all the usual signs of secondary action in the crushing of the rock or the reddening of the surface very much favors the idea of the primary nature of the gold: that it was disseminated through the molten magma at the time of eruption. Whether it is present in workable quantities or not has not yet been demonstrated. Judging both from the position of the white liparite and the absence of flowage structure, it seems probable that it has simply welled up in the position in which it is found.

SAN BERNARDINO COUNTY.

This county has wonderfully diversified mineral resources. There are now in active operation mines of gold, silver, lead, copper, borax, salt, lime, cement, marble, granite, sandstone, and macadam rock. Besides, there are also deposits and veins of iron, tin, zinc, manganese, asbestos, gypsum, baryta, soda, and sulphur. Hot and cold mineral springs are numerous also. Since our last report several new gold fields have come into notice, the most prominent being Shadow Mountain, Goldstone, and Coyote Holes, each of which will in time doubtless add to the wealth of the county. The borax industry, now large, will probably increase in proportions, as new and extensive fields of calcium borate have been discovered. The silver mining industry at Calico is also about to be revived.

Althea (*Embody*) *Mine* (Quartz).—It is at Oro Grande. See our XIth Report, p. 361. H. Eaton, of Halleck, owner.

Altura (Altuma) Mine (Quartz).—This is 3 miles S. of the Rose Mine, and about 15 miles E. of Bear Valley Lake. There is at present no machinery on the mine. A shaft has been sunk 63 ft. on a 3 ft. vein and a drift run 150 ft., from the bottom of which a winze has been carried down on the ore. Wood suitable for fuel is abundant, but water is scarce. Altura Mining and Milling Company, owners; Judge C. E. Otis, of San Bernardino, President.

Alvord Mine (Quartz).—It is 23 miles N.E. of Daggett. See our VIIIth and XIth Reports, pp. 499 and 359. Alvord Mining Company, owners; W. U. Masters, of Pasadena, President.

Bear Valley Region.—The geology of this portion of the San Bernardino Mountains is very interesting. From the main range of these mountains, the axis of which is E. and W., the entire country is granite to the south side of Bear Valley. Along the spurs extending into Bear Valley from the high hills on the south may be seen remnants of an ancient channel. The wash consists of well-rounded pebbles and cobbles of granite, quartzite, slaty rocks, and some eruptive rocks, all of which are foreign to the immediate neighborhood, excepting the granite. This mass of washed material is bedded in a coarse granitic sand. Panfuls of the cemented wash were "prospected," as was also the concentrated result of natural erosion in some of the near gullies which cut into the deposit, but in no case was gold discovered. The cemented wash is usually covered with a heavy accumulation of angular and sub-angular cobbles, mostly quartzite and finer granitic sand and rock fragments. On the north side of Bear Valley Lake limestone occurs, and farther north quartzite and mica schist, uplifted and fractured by intrusive granite. The metamorphic rocks, consisting of limestone, quartzite, and mica schist (the latter occurs in relatively small amount), are a portion of the series which extends from near Twenty-nine Palms northwest along the northern flanks of the San Bernardino Mountains to West Camp, 12 miles N.W. of Victor, a distance of 85 miles. Remnants of lime formation southeast of Twenty-nine Palms, in the Ophir Mountains, indicate that this lime formation is over 130 miles in length. Along this distance the quartzites appear, being well developed at Oro Grande, about Bear Valley, Holcomb Valley, and eastward as far as Ophir Mountains, which lie south of the Monte Negras and north of Eagle Mountains. Gold, silver, and lead occur along the entire length of this belt. The formation is everywhere much disturbed and shattered. Granitic dikes are thrust into the sedimentary rocks, faulting, crushing, and folding them; dikes of diorite and felsitic and porphyritic rocks also play an important part in this connection. The mines are found where the greatest disturbance seems to have occurred. A notable instance is in the Gold Mountain Mine. A close inspection of quartzite at some distance from any of the so-called ore bodies of this mine showed the frequent occurrence of finely disseminated iron sulphurets. In view of this fact, it appears that the crushing of the quartzite has afforded an opportunity for the decomposition of iron sulphurets in considerable quantity in large masses of the rock and the infiltration of gold-bearing solutions, derived from the normal rock, into those portions best prepared for their reception, by their crushed porous condition, thereby enriching such zones of rock. That all, or nearly all, the mineral-stained quartzite contains gold in small quantity there is little doubt. At Silver Reef, near the lower end of Texas Cañon, the quartzite contains, besides gold

and silver, sulphides of iron, lead, zinc, and copper. In the region about the Rose Mine the limestone carries chiefly gold; at Oro Grande the ores in the limestone are lead, silver, and gold, no deposits of either gold, silver, or lead having as yet been discovered in the quartzite in that district, though the indications for finding gold-bearing deposits similar to those of the Gold Mountain are promising.

Black Hawk Group of Mines (Quartz).—They lie 40 miles S.E. of Victor, and embrace the Lookout and Santa Fe. They all lie on the north slope of the Black Hawk Mountains, in a series of benches or terraces, the result of several faults, having an easterly and westerly trend. The entire region for miles is greatly disturbed by faults, of which there are several series. In Black Hawk Cañon, gneissoid rocks and crystalline limestone are found overlying beds of sand and cobbles, which have every appearance of having been formed recently, and bear a marked resemblance to the loosely cemented sandstone and conglomerate near the Cajon Pass. The local disturbances are numerous, and the whole region offers a field of interesting study to the student of structural and dynamic geology. During the fall of 1894, preparations were in progress to sluice the dumps of the Lookout Mine, and an arrastra was being built to crush rich rock from the Santa Fe. See our Xth and XIth Reports, pp. 524 and 364. Cook, Leach & Co., of Victor, owners.

Boomerang Mine (Quartz).—This is 2½ miles W. of Vanderbilt, and is one of a group of seventeen claims. The principal development and apparently the largest and best defined crevice and ore shoots are on the Boomerang claim. The fissure strikes N. 55° W., and is opened to a depth of nearly 400 ft. Near the main shaft a branch extends to the eastward at an angle of 20° with the main vein. This crevice has produced some high-grade rock. On the southwest side of the Boomerang vein is another vein nearly parallel with it, but probably a part of the same system. There are several small veins on the west side, none of which are developed sufficiently to make it possible to say much about them. The Boomerang vein differs quite materially from the other veins of the district, as the ore occurs in a dike of light-gray rock of fine texture. This dike is from 1 to 15 ft. wide. It is fractured, as far as exposed, by a system of nearly parallel fissures. Between these the dike rock is crushed and pulverized to a greater or less extent, and in these shattered portions of the dike the ore shoots have been deposited, the amount of ore and quartz appearing to be directly proportional to the amount of crushing sustained by the dike rock previous to the infiltration of the ore-bearing solutions. Southward from the main shaft is a shoot of ore 5 ft. wide, which farther southeast divides into two veins, each less than a foot wide. Along this portion of the mine the dike is broad, but farther south it becomes narrower, and at the face of the southeast drift has dwindled to 1 ft., with the pay shoot lying on one side of it, the quartz being but 4 in. in width. A vein-like mass of low-grade quartz appears here on the foot-wall side, which can be traced for hundreds of feet southeasterly on the surface. This portion of the mine is entirely undeveloped. The Boomerang Mine has a 10-stamp mill. The main shaft has now about reached the level of the valley, 350 ft. below, and water is coming in, and the probability is that the flow will be largely increased with additional depth. See Vanderbilt District, also XIth Report, p. 367. Green Campbell, of Vanderbilt, owner.

Burnap Mines (Quartz).—These are in Upper Holcomb Valley. The veins consist of several small fissures in the granite, on which some superficial work has been done. In one place a shaft was sunk to a depth of 40 ft., and a vein of gold-bearing quartz, carrying iron sulphurets, exposed. Half a mile up the gulch there are several small holes, exposing a quartz vein carrying a large amount of hard limonite ore. This is supposed to be the vein from which came the enormously rich iron "float" found in the placers of the region; but though the quartz and iron of the vein carries gold, no rock approaching in richness that found in the placers has thus far been discovered. J. Burnap, of Los Angeles, owner.

Center (Livingston) Mine (Quartz).—It is 4 miles E. of the Rose Mine. It is now equipped with horse and gasoline hoists and a 10-stamp mill. There are two inclines on the mine, each about 200 ft. deep; there are several surface cuts, all of which expose gold-bearing quartz. The west incline is on a narrow and extremely irregular quartz vein, ranging from a seam to nearly a foot in width; the narrow portions of this vein are very rich, and the work thus far done has been at a profit. This fissure cuts the formation (a rather massive, micaceous, and hornblendic schist) in both strike and dip at a low angle. In the neighborhood both quartzite and limestone were observed on the surface, neither of which has been encountered in the mine. The developments of the east portion of the mine show a zone-like mass of quartz and mica schist 10 ft. wide. Within the zone is an irregular, apparently independent vein-like streak of quartz, which is heavily mineralized and much richer than the zone of gold rock in which it occurs. Morongo King Mining Company, of San Bernardino, owners; C. W. Allen, President.

Chippy Mine (Quartz).—It is in Vanderbilt District, and embraces four distinct veins, which converge in the direction of the Queen of Night shaft. These several veins are smaller than those in the Gold Bar and Gold Bronze mines, and the crevices are not as well defined, but the average of the ore is richer than that found in the others. See Vanderbilt District, also our XIth Report, p. 367. J. P. Taggart, of Vanderbilt, owner.

Christie Mine (Quartz).—This is at the head of Lone Valley, and is the first extension west of the Rose Mine. The shaft is 193 ft. deep. A drift from the bottom of the 165 ft. shaft encountered a body of rich ore, which there is every reason to believe is on the succession of shoots occurring farther east in the Rose Mine. The property is as yet without a mill. E. Pratt, of Glendora, owner.

Coyote Holes.—In the latter part of August, 1894, a discovery of gold-bearing veins was made in the metamorphic rocks N.E. of Calico, near Coyote Holes. A number of prospectors immediately went there and located the entire district. The gold occurs in a decomposed, "honeycombed" quartz rock.

Eastern Districts.—In the eastern portion of San Bernardino County there are a number of mining districts, some of which have been known for many years. The principal ones are *Vanderbilt; Ivanpah*, 23 miles N.W. of Vanderbilt; *Shadow Mountain*, 55 miles N.W. of Vanderbilt; *Providence Mountain; New York; Ibex; Gold Stone*, and *Exchequer*, near Homer Station, on the line of the A. & P. R. R.

Gold Bar Mine (Quartz).—This is at Vanderbilt, and has a strike N. 63° W., dipping 80° to 85° N.E. The crevice is clean and well defined,

having heavy gouge matter and masses of clay. A dike rock much decomposed accompanies the fissure. The ore forms in shoots in the shattered and crushed portions of the crevice. In some places two distinct veins of ore were observed. The ore shoots have a persistent habit of overlapping both in depth and longitudinally. On one level drifting westward the vein pinches, leaving a barren crevice. A cross-cut into the hanging-wall discovered the vein on that side of the crevice. A notable fact in this connection is that at the place where the ore disappeared and the overlap occurred the hanging-wall was very soft and spalled off in great slabs of clay-like material, clearly showing the tremendous movement and pressure that had occurred at that point. The clay was filled with small angular fragments of quartz and blotches of ore. In fact, there was every indication that the ore might be found in the hanging-wall. In sinking the main shaft a similar occurrence was noticed. The shoot pinched, leaving the crevice well defined but without ore. A few feet farther the ore reappeared on the foot-wall side. There are two shoots of ore now exposed in this mine, which appear to average 2½ ft. in width. It has the appearance of being a fissure of great depth. See Vanderbilt District, also our XIth Report, p. 376. St. George Mining Company, Mackay, Flood & Lyle, of San Francisco, owners.

Gold Bronze Mine (Quartz).—See Vanderbilt District. This is practically the same as the Gold Bar fissure, and resembles the latter in many of its features, though the crevice is not as sharply marked and is rather smaller. There are two shoots of ore, which were developed to a depth of 180 ft. in May, 1894. The shaft is being sunk deeper at this writing. The difference in the two fissures is probably due to the fact that in the Gold Bronze claim the main fissure has divided into four or more distinct crevices, but with greater depth these will probably unite and form a vein as wide and as clearly defined as that in the Gold Bar. This mine is equipped with a steam hoist and 10-stamp mill. See our XIth Report, p. 367. Gold Bronze Mining Company, of Vanderbilt, owners.

Gold Mountain Mine (Quartz).—It is 7 miles N.E. of Bear Valley Lake, on a quartzite mountain overlooking the Mojave Desert. The quartzite is greatly shattered and in some places crushed and pulverized. In those portions which have sustained the greatest amount of crushing, bodies of massive quartz of irregular shape and size have formed, and it is these portions that contain the greatest amount of gold. The 40-stamp mill was burned, since which time nothing was done until 1893, when an experimental mill was built. This was abandoned after a short trial. It is rumored that operations on a large scale are to be resumed. E. J. Baldwin, of San Francisco, owner.

Gold Placers were discovered in May, 1894, in the low desert hills 3 or 4 miles N. of Ord Mountain. Two men were at work here prospecting the small ravines and depressions with a dry washer. The result, judging from the frequent change from place to place, was not all that could be desired. The occurrence of a mass of red conglomerate near the washes where the gold was obtained, suggested the possibility that the gold might have come from that source. The material was "prospected" in several places, but gave no trace of gold.

Gold Stone District lies in the Providence range of mountains, 35 miles N.W. of Fenner Station. Some extremely rich gold quartz was

found in this district in May, 1894. Two men were at work on the claim at the time.

Holcomb Valley District.—It is 4 miles N. of Bear Valley Lake, and has long been known as a placer region. See our Xth Report, p. 523.

Holcomb Valley Company (Limited) owns in Holcomb Valley a large tract of placer ground, which, after several unsuccessful attempts to work, they are now sluicing on quite an extensive scale, employing a steam shovel, a separating machine, and elevators, the latter being used to dispose of the coarser tailings. The gold-bearing material is not "gravel" in the ordinary sense of the term, but a coarse, angular, granitic detritus, containing very few washed or rounded stones. The material is mostly small. Occasionally cobbles occur, but these are exceptional. The gravel is overlaid by 4 to 8 ft. of light, loamy material, while the substratum contains more clay and is also richer in gold. The ponderous steam shovel is mounted on a car quite similar to an ordinary flat car, and is moved backward and forward as required, on a track built on a crib of timbers. The machine is advanced toward the bank of alluvial from time to time; it takes up about a cubic yard of gravel and sometimes more, at each load, and dumps it into a hopper, which, by means of a feeder, discharges into a revolving screen. This causes a separation of coarse and fine material. The coarse pebbles and cobbles pass through the screen and are taken up by the buckets of an endless elevator, which delivers them to a second belt elevator, so arranged as to deposit the tailings on the bank of the cut 30 ft. distant. The fine material passing the meshes of the rotary screen drops into the sluice-box beneath, and is carried by a stream of water over the riffles and blankets. The fine tailings are conducted through a half-round steel flume, from the foot of which they are shoveled out of the tail-race by hand. The capacity of the plant is from 1,000 to 2,000 yds. per day, depending on the water supply, which, during the past season, was very low. The management expressed considerable satisfaction at the operation of this plant, as it is the only means thus far employed which assured success to their undertaking. Holcomb Valley Company (Limited), of London, owners; W. E. Pedley, of Victor, Superintendent.

Holcomb Valley Mining Company (Placer).—They own a tract of placer ground near the head of Upper Holcomb Valley. During June, 1894, a shaft was sunk, and a large quantity of water was encountered, but it was hoped that by continued pumping bedrock could be reached It is said that a large amount of coarse gold has been taken from the upper part of the valley. Holcomb Valley Mining Company, of Los Angeles, owners; J. Burnap, of Los Angeles, Superintendent.

Ibex Mine (Quartz).—It is 3 miles S. of the A. & P. R. R., and 11 miles N. from The Needles. (Not to be confounded with the Ibex Mine, near Death Valley.) A mill was built in the spring of 1894. Permission could not be obtained to investigate the mine, consequently nothing definite is known of its workings or character. See our XIth Report, p. 368. Ibex Mining Company, owners; Chas. A. Marriner, corner First and Broadway, Los Angeles, Superintendent.

Lytle Creek (Placer).—The mines of Lytle Creek, which for years had been worked in a desultory manner, became the scene of active operations during the summer of 1894. In June no less than 50 men were at work along the stream, and this number was augmented almost daily

by new arrivals, until upwards of 100 men, mostly working independently, were engaged in gold washing. Four miles above the old Texas Hill Mines hydraulicking was carried on in a small way, and it was generally believed that all the mines engaged in sluicing, rocking, and hydraulicking were doing well, though all were reticent as to the amount of gold actually being produced. These placers extend from near the mouth of the Lytle Creek Cañon to its headwaters on the slopes of San Antonio Peak. Quartz veins, bearing gold, are located in many places along the cañon, and on these more or less work has been done, but none of them are in active operation.

Morongo King Mining Company (Quartz).—See Center (Livingston) Mine, and our Xth Report, p. 526.

Morongo Mine (Quartz).—See our VIIIth Report.

Morongo Mining Company (Quartz).—See Rose Mine, and our IXth Report, p. 226.

Old Woman's Springs.—In July and August, 1894, there was much interest manifested in the reported discovery that the scoriaceous basalt at Old Woman's Springs was gold bearing, and numerous claims were located. The amount of development work, however, was small, and though the claim owners professed to believe the lava rich in gold, few of them gave practical evidence of their good faith.

Ord Mountain District contains several large mineral deposits, some of which assume a vein-like form. In each the veins consist of silicious impregnations, with iron and copper sulphurets, oxidized at the surface, gold occurring in greater or less quantity. The veins have in every instance formed along a zone of crushed diorite, showing distinct overlaps and a branching tendency. The principal vein is plainly defined for a long distance on the surface. Several hundred feet of development shows clearly the geological features of the vein, which varies in width from 1 to 8 ft. None of the mines were being worked during the past year. See our IXth and Xth Reports, pp. 222, 226, 528. J. B. Osborne, of Daggett, owner.

Osborne Placers.—They are in the middle portion of Upper Holcomb Valley. J. B. Osborne, of Daggett, owner.

Rose Mine (Quartz).—It is 65 miles N.E. of San Bernardino, and about 15 miles E. of the Bear Valley reservoir. The mine is equipped with a 5-stamp mill and grinding-pan. Geologically the mine is an unusual one, consisting of a succession of ore shoots or chambers along a line of fracture which extends E. and W., dipping about 45° N. The fissure cuts at a small angle through crystalline limestone, quartzite, and a mica schist, being usually accompanied by a dike of granitic rock, which is never absent where an ore body is found. The ore bodies occur in regular form and size, and are chiefly a mixture of quartz and calcite, with a varying but usually a large amount of scaly hematite (sometimes containing as much as 45 per cent of iron). The gold occurs in a greater or less amount, depending on the proportion of iron. Heavy hematite ore has been shipped in considerable quantity, containing $200 to $500 per ton in gold. Owing to the fact that the gold appears to be covered with a film of iron oxide, a simple sampling of the ore has not been found sufficient to render the particles easily susceptible to amalgamation, and a subsequent grinding of the tailings has been resorted to, with good results. During the month of July, 1894, a large quantity of tailings was being ground a second time. The

main incline, at some distance from the surface, passes from the fissure into the hanging-wall. This shaft is sunk at a point where the series of ore chambers reach the surface. As depth is attained, the ore passes to the west, and at the bottom of the shaft, 450 ft. in depth, the ore lies nearly 300 ft. W. The lower western portion of the mines was being diligently prospected in July, 1894, for new ore bodies, with very favorable indications of the close proximity to a "shoot." That portion of the property lying east of the main shaft, while not neglected, has received comparatively little attention, and the existence of an ore body in that direction remains to be determined. No considerable amount of cross-cutting has been done, though the appearance of the "ground" in many places suggests the advisability of such a course. The high grade of the ore and its unusual geological features have attracted much attention, and have been an incentive to a large amount of prospecting in the vicinity. See our IXth Report, p. 226. The Morongo Mining Company, of Riverside, owners.

Sidewinder Mine (Gold and Lead).—It is 14 miles N.E. of Oro Grande, and is being worked by a small force and the ore shipped to smelting works. It contains some lead, but is practically a "dry" gold ore. See our Xth Report, p. 527. Joseph Driscoll, of Oro Grande, owner.

Upper Holcomb Valley is half a mile east of Holcomb Valley, and has long been known as a placer region. In neither this valley nor Holcomb Valley proper is water for placer mining abundant, nor is the slope of either valley sufficient to afford good dumpage. Drain tunnels have been projected several times, but none of them have been undertaken. As the area of ground to be worked in either case is small, it is a question whether the amount of gold which may be obtained from such operation would justify a lengthy drain tunnel. See our Xth Report, p. 523.

Vanderbilt District.—It is 4 miles by wagon road from the present northern terminus of the Nevada Southern Railroad at Manvel, being situated among the hills which form the northeastern end of the New York Mountains, which are a portion of the Providence range. The geology of the district is quite simple. The rocks of the region are chiefly gneissoid and schistose granitic and hornblendic rocks, with large masses of the variety of granite called pegmatite, which in some parts has exceptionally coarse crystallization, containing a large amount of rose-colored orthoclase and very little mica. In fact, the almost total absence of mica of any variety from these rocks is a noticeable feature. Later intrusive dikes of a variety of rocks of granitic type, between felstone and aplite, occur throughout the region, but not abundantly. These dike-like masses are found accompanying all of the principal fissures, though also occurring where no ore channels are found.

The strike of the country rocks, over an area of 20 square miles of this region, is almost uniformly N. and S., the dip varying, but usually nearly perpendicular. The eastern borders appear to become more gneissoid, and contain more hornblende rocks than the section immediately about the village, and westerly is found a belt of limestone, beyond which occurs syenitic granite of normal type. Large dikes of rhyolite and vitrophyre occur in these western granites, and ferruginous quartz veins also, which contain some gold, but are usually low grade and not of a

character to excite much attention; still farther westward the quartz veins are very large and are stained with copper carbonate.

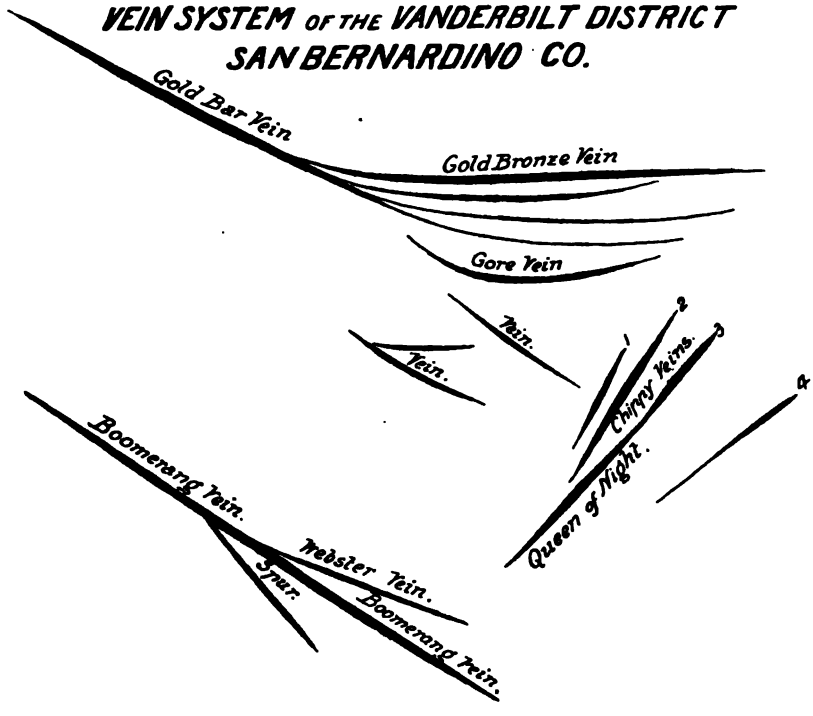
These highly metamorphic schists and granites are doubtless partly metamorphic, as indicated by the occurrence of limestone, but the greater portion of the pegmatite granite, as well as the more recent felstone, is eruptive. All about the eastern and southern borders of this district the rocks are overlaid by heavy accumulations of rhyolite, tufa, and scoriaceous lavas, which are piled up to a height of nearly 1,000 ft., though doubtless greatly denuded. The successive flows are clearly denoted in the terrace-like appearance of the cliffs. White tufas form the base of the series. The rhyolites are of several types, and form an interesting petrographical study. These rocks dip away from this region in a southeasterly direction, and have no apparent connection with the mineral veins of the district. They resemble the liparites of Calico, but no ores have, as yet, been found in them.

The Vein System of the Vanderbilt District forms one of those peculiar studies in dynamic geology which this interesting desert region so frequently affords. The first impression of the visitor is that the veins are scattered indiscriminately, without apparent relation to each other. A closer observation, however, shows that they are grouped in systems, have direct relations, and are all due to common causes, viz.: The fissuring of the rocks by what appears to have been a compound stress of opposing forces; the injection of dikes along many of the planes of weakness thus formed; a subsequent movement of the rocks, and later, the deposition of ores in these fissures. Subsequent to the formation of the ore shoots these fissures have been subjected to further movement, resulting in a crushing of the ore and quartz and the formation of striated planes and selvages of clay. Cross-fissures (faults) also occur, which in some cases appear to have either displaced the veins, as in the east end of the Gold Bronze Mine, or have had a direct influence on ore deposition, retarding it, as in the northwestern end of the Gold Bar and Boomerang mines.

There are two chief systems of fissures in this district—the Gold Bar system lying on the east side of the area of veins, and the Boomerang system on the west. The Gold Bar fissure is the most pronounced and sharply defined crevice in the district. Beginning at its northern end, it strikes S. 63° E. for 1,200 ft., where it sends out a branch, which sweeps around to the eastward, forming the Gold Bronze fissure, striking due E. and W. Beyond the point of divergence the main fissure continues southeasterly, sending out branch after branch. At least four others have been determined, all of which curve around to the east. There is no doubt but that these veins reunite with the Gold Bronze vein in depth. The insufficient development affords no safe guide to this.

The Boomerang system lies 1,000 ft. to the westward, and the main crevice strikes N. 55° W. It also sends off branches in going southward, though they are fewer in number than on the opposite side of the ridge. The principal one of these has a strike S. 70° E. A peculiarity of these two vein systems is that nearly all the branches are to the south and east.

A third system occurs between the two systems described, in which the main crevice (in Chippy Mine) strikes N. 30° E., and to the southward another crevice striking N. 45° E. A shaft on the east end of this



claim is on a vein striking N. 50° E. It will be noticed that all of these veins converge toward the west, and would unite, if their respective courses continued as observed, near the Queen of Night shaft, where the vein strikes N. 45° E.

Besides the three systems here described, there are several small veins on which little has been done or where the development exposes crevices so small as to make any particular statement concerning them valueless.

The future prosperity of the district lies largely with the mine owners themselves. The fissures have every indication of being deep, and are usually well defined. The ores can be worked to the best advantage by amalgamation on plates and concentration of the sulphurets on vanners and canvas tables. A lack of water, which at present is a material detriment, will be overcome with greater depth of the workings. The "Gilpin County," Colorado, stamp mill on the Gold Bronze Mine, with a 16 in. drop 30 times per minute, and a "bumping table" for a concentrator, does not appear to give the most satisfactory results.

SAN DIEGO COUNTY.

Mining operations throughout the county show increasing activity, both in the search for new deposits and in the revival of those long dormant. Aside from the opening up of large new mines such as the Golden Cross in the Cargo Muchacho District, and smaller ones in Pine Valley and Mesa Grande districts, we find over twenty mines in operation in the Julian District, where two years ago there were but three.

The desultory method of prospecting in the Colorado Desert continues, and the introduction of the gasoline engine has solved the fuel problem in a great measure. Large granite quarries are in successful operation around Fosters, near the Cuyamaca Railroad.

Antelope Mine (Quartz).—It is 2 miles N.E. of Julian, on the Banner grade. Working. See our XIth Report, p. 380. Bailey Bros., owners.

Bay View Mine (Quartz).—It is in the Pine Valley District, 9 miles E. of Descanso, and 9 miles S.E. of the Stonewall Mine. The mine is one of the *Noble group*, comprising the *Bay View*, *Eureka*, *Oxide*, and *Spring* claims. In the Eureka claim is a second vein, called the *Treasury*. This group has made an interesting record. They were discovered by one of the present owners about six years ago, when their means were too limited to provide anything better than an arrastra. To-day there are about 1,000 ft. of cuttings, consisting of shafts, drifts, crosscuts, and surface workings, exposing veins from 1 to 6 ft. wide. The mines within the past five years have paid for all the developments, and realized besides a handsome net sum. The small mill is run with a Knight waterwheel. The mines are little talked of and not frequently visited, but are evidently possessed of more merit than is generally credited to them. See our IXth, Xth, and XIth Reports, pp. 141, 544, and 382. Noble & Sons, of Descanso, owners.

To the eastward of Pine Valley, and extending south toward Buckman's Springs, are several large veins of quartz. No workings were observed, and it is probable that no gold has ever been found in them.

Black Eagle Mine (Quartz).—It is in the Mesa Grande District, 10 miles N. of the Santa Ysabel ranch, which is on the stage road between San Diego and Julian. There are several small gold mines in the district, which geologically resemble those between Julian and Banner, and are on the same belt. The principal locations are the *Shenandoah*, *Wildcat*, *Gold Cliff*, *Black Eagle*, *June*, and *Blood Pudding*, all of which, excepting the latter, are owned or under bond to the Shenandoah Mining Company. The Shenandoah Mine is equipped with a 5-stamp mill; all operations are conducted on a small scale. None of the mines are deep, and as admission to any of them was refused by the management, nothing further can be said of them. See our XIth Report, p. 382. J. B. Debney, of Mesa Grande, Superintendent.

Blood Pudding Mine (Quartz).—See Black Eagle.

Blossom Mine (Quartz).—It is in the Cargo Muchacho District, 4 miles E. of Ogilby Station, and is equipped with a mill.

California Picacho Mine (Placer-Hydraulic).—Consists of a large tract of gold-bearing gravel on the west side of the Colorado River, 27 miles from Yuma by trail and 50 miles above the town by river. It is said that $240,000 have been sent here by an English company in pumps, flumes, and development, but in May, 1894, the enterprise looked very much like a failure. Twenty men were at work on a system of leases, but the extensive operations formerly contemplated did not materialize. Too low a pressure to do effective work, and insufficient grade for dump, are apparently largely the cause of the failure. Allan T. Smith, of Yuma, A. T., Superintendent.

Cargo Muchacho District.—It is in the S.E. corner of the county, and has been known for many years, and in the past has produced a large amount of gold. There are two corporations now operating in the district, one the Paymaster Company, lessees of the *Cargo Muchacho Mine;*

the other, the Golden Cross Mining Company, working what was formerly known as the *Gold Rock Mines*. Besides these, there are the *Blossom*, the *Pasadena*, and *Mother Lode* mines.

Cargo Muchacho Mine (Quartz).—It is 4 miles from Ogilby Station, on the S. P. R. R., and 16 miles from Yuma, A. T. The vein strikes N. and dips 45° to 60° E. The country rock is a crystalline hornblendic rock, having a gneissoid structure. The vein is from 1 to 5 ft. in width ordinarily, but in a few places is more than 8 ft. The main shaft is 550 ft. deep. A shaft south of this is 200 ft. deep. Between the 350 and 450 ft. levels, a fault pitching about 20° E. has thrown the vein. The indications are that the downward continuation of the main vein lies west of the shaft. Cross-cuts to the east have exposed two other veins lying nearly parallel, which for some months past have furnished the chief supply of quartz. These veins have a somewhat different appearance from the main fissure, being feldspathic and of lower grade. A second nearly perpendicular fault occurs in this mine several hundred feet north of the main shaft, striking across the vein. North of it no quartz has been found in the workings. A gulch on the surface appears to mark the line of this fault. The property is leased by the Paymaster Company. A 20-stamp mill has been constructed at the mine from the machinery formerly in the Paymaster mill and the mill at El Rio. Water in the district is very scarce, and to supply this a pipe-line 12 miles in length has been laid from the Colorado River to the mine. The expense is from $12 to $15 per day, the water being raised 300 ft. The tailings are settled and the water pumped to a tank above the mill, to be reused, it being cheaper than to pump the entire amount required from the river. Heavy woolen blankets are laid in the sluices below the copper apron plates. The concentrates are largely limonite and magnetite, and a very small percentage of sulphurets. These are ground and then amalgamated in an iron revolving barrel. The premises and portions of the mine are lighted by electricity. Small electric motors are employed to drive ventilating fans, and on one level an electric hoist is used to raise rock from a winze. Although the lowest portion of this mine is 550 ft. below the surface and 200 ft. lower than the Colorado River, it is perfectly dry. Paymaster Mining Company, of Yuma, A. T., lessees.

Chaparral Mine (Quartz).—This is in the Julian District, on the Banner grade, 2½ miles from Julian. Working. W. W. Boswell, of Banner, owner.

Chief of the Hills Mine (Quartz).—It is in the Dulzura District, 30 miles E. of San Diego. See our XIth Report, p. 382. M. O'Reilley, of San Diego, owner.

Cincinnati Belle Mine (Quartz).—This is also in the Julian District, half a mile N.W. of Banner, Cal. See our XIth Report, p. 380. Gold King Mining Company, of Pomona, Cal., owners.

Cravath Mine (Quartz).—It is 2 miles S.E. of Escondido. Idle. See our VIIIth and IXth Reports, pp. 524 and 382. Gus. Cravath, of Escondido, owner.

Dulzura Mining District.—It is 30 miles E. of San Diego. See our XIth Report, p. 382.

Ella Mine (Quartz).—It is in the Indian District, 2 miles N. of Julian. The mine, though one of the oldest in the district, has recently come into prominence by the new developments, which expose several veins

of gold-bearing quartz. The rock from this mine is similar to that found throughout the district: a rather pellucid, semi-granular quartz rock, containing innumerable small black, needle-like inclusions, disseminated iron sulphurets, and gold. The walls are mica schist, much shattered and decomposed. The country in the immediate vicinity is intruded by numerous dikes of coarse granite. The quartz is quite rich, and in places gold may be seen in the granite itself. There are heavy gouges on the walls of this mine, which appear to be due to movements which have taken place since the formation of the vein. The vein quartz is much shattered, and tends to corroborate this idea. About 100 tons of quartz were on the dump awaiting transportation to mill. In operation. See our VIth Report, p. 85. S. N. Wilcox, of Julian, owner.

Escondido Mine (Quartz).—It is 2 miles E. of Escondido. After a period of idleness preparations were being made in August, 1894, to resume operations on this property. See our VIIIth and IXth Reports, pp. 524 and 382. G. W. Fredericks, of Escondido, Superintendent.

Eureka Mine (Quartz).—See Bay View.

Gold Cliff Mine (Quartz).—See Black Eagle.

Golden Chariot Mine (Quartz).—Situated in the Julian District, 6 miles S.E. of Banner. See our VIth and IXth Reports, pp. 86 and 147. Pacific Bank, of San Francisco, owners.

Golden Cross Mining Company.—They own a large group of claims in the Cargo Muchacho District, 6 miles N.E. of Ogilby Station, on the S. P. R. R. The principal claims are the *Golden Cross*, *Golden Crown*, and *Queen*. These were formerly known as the Gold Rock Mines. They are all similar geologically, and constitute a remarkable group. The gold-bearing rock is in no sense a vein, nor can it be considered as deposits of ore replacing country rock. The gold occurs in a country rock, which appears to be a silicious hornblende schist, though the schistose structure is not very distinct in the gold-bearing portion. Large amounts of epidote occur, as a result of the alteration of the hornblende. They are technically bedded deposits similar to those found in the southern portion of the Black Hills, S. D. The deposits are intruded by large and small dikes and irregular masses of granite, and are overlaid by strata which greatly resemble the gold-bearing rock, excepting that the former contain a great deal of feldspar, which, being kaolinized, gives the rock a hard, dry appearance. There are several of these strata containing gold, ranging from 15 to 40 ft. in thickness, and at one point a vertical shaft passes through 90 ft. of rock containing gold. The longitudinal extent of the gold-bearing formation has not been determined. In June, 1894, the main incline had reached a depth of 350 ft. Several displacements of 15 to 20 ft. were exposed in the workings. The company has a 40-stamp mill, in which 100 tons of rock are crushed daily. Water is supplied by a pipe-line from the Colorado River, 12 miles distant, at a cost of $18 to $22 per day, the quantity of water varying from 100,000 to 125,000 gallons daily. The water is raised 500 ft. In constructing the mill the mistake was made of placing it on a low flat, in the endeavor to have a site from which all the mines would be easily accessible. Though in operation but a few months, elevators are constantly employed raising tailings to a point where they will flow away from the mill. The pile of sand is already 10 ft. high, and has encroached upon the mill to such an extent that it became necessary to construct a bulkhead. There are several sites in the immediate vicinity where rock foundation and

abundant dump can be secured. Golden Cross Mining Company, owners; T. S. Fuller, of Hedges, Secretary.

Golden Cross Mine (Quartz).—See Golden Cross Mining Company.

Golden Queen Mine (Quartz).—See Golden Cross Mining Company.

Gold King Mine (Quartz).—It is in the Julian District, 4 miles S. of Banner. See our VIIIth, IXth, Xth, and XIth Reports, pp. 513, 143, 543, and 381. Gold King Mining Company, of Pomona, owners.

Gold Queen Mine (Quartz).—This is also in the Julian District, 4 miles S. of Banner. See our VIIIth, IXth, Xth, and XIth Reports, pp. 513, 143, 543, and 381. Gold King Mining Company, of Pomona, owners.

Gold Rock Mines (Quartz).—See Golden Cross Mine.

Gold Rock Mine (Quartz).—See Black Eagle.

Helvetia Mine (Quartz).—It is in the Julian District, 1½ miles E. of Julian, and has lately passed into possession of a Los Angeles company, and all energies are being directed to its development. See our IXth, Xth, and XIth Reports, pp. 145, 542, and 376. E. W. Reed, of Julian, Superintendent.

Hidden Treasure Mine (Quartz).—This is in the Julian District, on the Banner grade. Working. Bailey Bros., of Banner, owners.

High Peak Mine (Quartz).—It is in the town of Julian. Working. See our Xth Report, p. 542. Horace Wilcox, of Julian, owner.

Hubbard Mine (Quartz).—It is at Banner, in the Julian District. Working. See our VIth and XIth Reports, pp. 87 and 380. Bailey Bros., of Banner, owners.

Jaynes' Mine (Quartz).—This property is 55 miles above Yuma, on the Colorado River, 5 miles above the Picacho Placer Mines. There is a 20-stamp mill connected with the mine. The vein is large. The workings have reached a depth of 200 ft. Dr. Jaynes, of Philadelphia, Penn., owner.

Johnston's Mines (Quartz).—They are in the Dulzura District, 30 miles E. of San Diego. Development work only is done. See our XIth Report, p. 382. — Johnston, of Dulzura, owner.

Julian Mining District.—This includes the mines at Banner and vicinity, among which are: Antelope, Chaparral, Cincinnati Belle, Ella, Gold Rock, Helvetia, Hidden Treasure, High Peak, Hubbard, Kentuck S., Lucky Ben, Madden, Neptune, Ready Relief, Redman, Ruby, South Hubbard, Warlock, Washington, and Wilcox. The district was found to be in a more prosperous condition in 1894 than for some years previous, and there is reason to believe that this new era is one likely to continue for some time, and to increase in importance as well. A system of leasing has been inaugurated, by means of which many small mines may be operated successfully and inexpensively. In 1892 there were but three mines in active operation in the district. In 1894 twenty mines were being actively exploited, with encouraging results, and negotiations for the leasing of several other properties were pending in July. Over 50 men are employed on the lease system. The quartz is crushed in custom mills at $3 per ton. Usually not less than 10 tons are sent to the mill at one time, unless the rock is very rich, which is not an uncommon thing in this district.

June Mine (Quartz).—See Black Eagle.

Kentuck S. Mine (Quartz).—It is in the Julian District, half a mile from Banner, on the road to Julian. Working. See our Xth and XIth Reports, pp. 542 and 380. N. Bailey, of Spencer Valley, owner.

Lucky Ben Mine (Quartz).—It is in the Julian District, near Banner. Working. Boswell & Walker, of Banner, owners.

Madden Mine (Quartz).—It is in the Julian District, 1 mile N.W. of Banner. Working. See our VIth Report, p. 86. Charles Bacon, of Banner, owner.

Mesa Grande District.—It is situated about 10 miles N. of Santa Ysabel P. O., on the Santa Ysabel ranch, which is on the road between San Diego and Julian. See our XIth Report, p. 382.

Mother Lode Mine (Quartz).—It is in the Cargo Muchacho District, 4½ miles E. of Ogilby Station, on the S. P. R. R. It is the first extension south of the Pasadena. It is being developed with a small force, and has a Huntington mill. See our XIth Report, p. 386. Dr. Mathison, of Ogilby, owner.

Neptune Mine (Quartz).—This is in the Julian District, near Banner. Working. W. W. Boswell, of Banner, owner.

Noble's Mines (Quartz).—See Bay View Mine.

Oro Fino Mine (Quartz).—It is 2 miles S.E. of Escondido, on the farm of F. H. Roberts. It was discovered in the spring of 1894. An incline shaft has been sunk on the vein to a depth of 40 ft. and a drift cut south along the vein. The quartz varies from 2 to 10 in. in width. The country rock is granite, much decomposed. John D. Hoff, of Escondido, Superintendent.

Owens Mine (Quartz).—It is in the town of Julian. See our VIth, VIIIth, IXth, Xth, and XIth Reports, pp. 85, 87, 519, 144, 541, and 378.

Oxide Mine (Quartz).—See Bay View Mine.

Pacific Mining District.—It is in the Chuckawalla Mountains, partly in San Diego and partly in Riverside County. Several new discoveries are reported. A prospector who spends most of his time in that region stated in the summer of 1894 that no rain had fallen in the district since 1889. See our Xth Report, p. 900.

Padre y Madre Mine (Quartz).—It is in the Cargo Muchacho District, 4 miles E. of Ogilby. Leased by the Paymaster Company.

Pasadena Mine (Quartz).—It is in the Cargo Muchacho District, 4 miles E. of Ogilby, on the S. P. R. R. See our XIth Report, p. 386. Thos. Grunes & Co., of Pasadena, owners.

Paymaster Mining Company.—See Cargo Muchacho.

Picacho Mine (Placer).—See California Picacho.

Pine Valley District.—See Bay View Mine.

Pot Holes Mines (Placer).—They are on the Colorado River, about half way between Yuma and the California Picacho Mines. In the summer of 1894, Mexicans were hauling the gold-bearing dirt to the rivers, there being no water at the mine.

Queen Mine (Quartz).—See Golden Cross Mining Company.

Ready Relief Mine (Quartz).—This property is in the Julian District, at Banner. See Julian District; also our VIth, VIIIth, IXth, Xth, and XIth Reports, pp. 87, 513, 147, 543, and 387. Bailey Bros., of Banner, owners.

Redman Mine (Quartz).—It is in the Julian District, at Banner, and is the northern extension of the Ready Relief. See our VIth and IXth Reports, pp. 87 and 380. Bailey Bros., of Banner, owners.

Ruby Mine (Quartz).—It is in the Julian District, at Banner. See our XIth Report, p. 380.

Shenandoah Mine (Quartz).—See Black Eagle Mine.

South Hubbard Mine (Quartz).—It is in the Julian District, half a mile W. of Banner. See our VIth and XIth Reports, pp. 87 and 380. Bailey Bros., of Banner, owners.

South Ruby Mine (Quartz).—It is also in the Julian District, at Banner. See Julian District. H. Barry, of Riverside, owner.

Spring Mine (Quartz).—See Bay View.

Stonewall Mine (Quartz).—This property is on the Cuyamaca Grant, 10 miles S. of Julian. Since the publication of our last report operations have been suspended. See our VIth, VIIIth, IXth, Xth, and XIth Reports, pp. 89, 515, 143, 540, and 382. Sather Banking Company, of San Francisco, owners.

Treasury Mine (Quartz).—See Bay View Mine.

Warlock Mine (Quartz).—It is in the Julian District, 1 mile from Banner, on the Julian road. See our Xth Report, p. 544. W. H. Bradley, of Los Angeles, and W. W. Boswell, of Banner, owners.

Washington Mine (Quartz).—It is in the town of Julian. See our IXth Report, p. 145. Ex-Sheriff McDowell, of San Diego, owner.

Wilcox Mine (Quartz).—It is in the Julian District, at Banner. See our XIth Report, p. 145. L. E. Lee Electric Supply Company, of San Francisco, owners.

Wild Cat Mine (Quartz).—See Black Eagle Mine.

SAN LUIS OBISPO COUNTY.

La Panza Mines (Placer).—The gold from these mines has been taken chiefly from two creeks, Navajo and De la Guerra, which head on the eastern slope of the San Luis range, near La Panza. While both creeks flow over granite for several miles where the placer gold is found, yet their very sources, particularly that of De la Guerra, are in the Chico conglomerates and sandstones, which cap the southern portion of the range. Whether the gold came from the sedimentary beds or from hidden veins in the granite is not certain. No gold-bearing quartz veins have been found. The gold is generally coarse. All the gold easily gotten at has been taken out, but the heads of many gulches, in which the bowlders are too large to move by hand, have never been touched. See our VIIIth and Xth Reports, pp. 530 and 578.

SAN MATEO COUNTY.

Auriferous beach sands occur along the shore of the Pacific Ocean for several miles in this county. They have been worked in a desultory sort of way by many persons, but as far as known without profit. The gold is very fine and is saved with difficulty.

SANTA CRUZ COUNTY.

Auriferous beach sands are found for miles along the coast of Santa Cruz County, and spasmodic attempts have been repeatedly made to work them. Under favorable conditions, the richer deposits have paid small wages to industrious workers.

Stribling Mine (Quartz).—This is 3 miles N.W. of Santa Cruz. Numerous shallow pits, cuts, and shafts have been made on the property, and one surface stope 30 ft. deep was made some years ago. A tunnel 100 ft.

long is run underneath this shoot of ore 25 ft. lower, but no good rock was found. A small stamp mill was erected several years ago, and this was replaced by a cannon-ball mill. The latter gave no satisfaction. Some new exploitation is contemplated at a lower level, the intention being to run a tunnel on the vein and cross-cut the several fissures. This mine is one of a number of points on the course of a mineral zone which trends in a N.W. direction through these granite hills. At one point a mile N.W. of the Stribling Mine, is what is known as the *Big Bowlder Mine*. It appears that years ago a large bowlder or mass of quartz was found lying on the surface of the ground, gold being seen on all sides of it. The bowlder was broken up and ground in arrastras, producing gold to the amount of $35,000 to $50,000, according to the various stories. A great deal of work of a superficial character has since been done in the vicinity, but nothing of value discovered, though small veins are numerous. The rich bowlder occurred in all probability nearly *in situ*, the soft, easily decomposable granite having been eroded from around it. The character of the deposits as far as observed is what is known as "pockety." The veins or masses of quartz form sometimes on the hanging- and sometimes on the foot-wall of the crevice, and again on both sides. Much of the so-called ore still shows the original granitic structure. Where the replacement has been more complete the quartz is massive and sometimes crystallized. All of the gulches and ravines heading in this gold-bearing region produce placer gold, and in the aggregate have yielded some thousands of dollars of the precious metals.

Thurber Mine (Placer).—It is 10 miles N.W. of Santa Cruz City, on Majors Creek; two men are working a placer mine for gold. The harvest of these laborers is evidently not great, as it is said they are working ground which has been sluiced twice before.

SHASTA COUNTY.

While having a diversity of economic mineral equal to that of any county in the State, Shasta does not take rank in point of output that it might, or that any person who has ever been over the ground would naturally expect. There are various causes for this, and it may be attributed, as far as her copper and silver ores are concerned, to the low prices of these metals, which preclude any profit being derived from the working of such mines, which are located on an extensive belt traversing the county.

That the gold output is not larger lies in the difficulty experienced in successfully working the ores on the spot. Comparatively few of the mines carry a true, free-milling ore, but depend upon the sorting and shipping of the high-grade sulphide ores, leaving the lower grades in the mine. None of the mines have attained a great depth, from an apparent fear of the owners that the pay ore does not extend down, although the success of such mines as the Uncle Sam and the Texas Consolidated would appear to indicate that these fears are groundless.

The county contains large areas of gravel, stretching from the neighborhood of Ono to the southwest, parts of which appear to be the remains of an ancient beach. Where they lie adjacent to the crystalline rocks they are gold-bearing, and may well repay, in places, the cost of drifting. An interesting fact in connection with the gravel deposits in this county is the development of pay gravel under 40 ft. of sandstone, as

found in the Sacramento Pliocene Mine, in Oregon Gulch. As this sandstone can be traced for quite a distance northward, it is possible that in other portions pay gravel may be encountered beneath.

It is much to be regretted that the works hitherto established in this county to handle its refractory gold ores, have not proved a marked success, allowing a lower grade of ores to be mined and worked. Parties, we believe, are again preparing to undertake this work with improved methods, and their success will mean an increased output of bullion, as well as the retention in the county of a large amount of money.

Alice Mine (Quartz).—It is 1,500 by 600 ft., and 6 miles N.W. from Ono. The vein courses N.E. and dips 24° W.; the walls are porphyry, with from 8 to 30 in. of quartz between them, which carries a large percentage of iron sulphurets. Developments consist of a cross-cut tunnel to the vein, 150 ft. long; one on the vein 200 ft. long, and giving 60 ft. of backs. None of the ore has been milled. J. J. Murray, of Ono, owner.

Alice Mine (Quartz).—This claim, 1,500 by 600 ft., is 2½ miles N. of Shasta. The vein, 4 ft. wide, courses N.E. and dips 55° S.W., between porphyry walls. The apex has been excavated for several hundred feet, and an incline shaft sunk to a depth of 40 ft. The ore carries 0.75 per cent of sulphurets. D. B. Hunt et al., of Stella, owners.

American Mine (Quartz).—It is in Kline's Gulch, 3½ miles from French Gulch, and comprises three 40-acre lots. The vein courses N. 63° E. and dips 75° S.E., between a porphyry hanging- and slate foot-wall, varying in width from 4 to 7½ ft. There are four tunnels; three run east on the vein, 90, 80, and 60 ft., while the lowest is a cross-cut, running due north in slate 650 ft. From 4 to 5 in. of water issues from the workings. A 5-stamp mill, run by water about seven months in the year, belongs to the property. J. Conant, of Redding, owner.

Anavina Claim (Quartz).—This claim, 1,500 by 600 ft., is 8 miles W. of Redding. The vein courses N. and S., dipping a little E., between a black shale foot- and a quartzite hanging-wall. Developments consist of a shaft sunk 54 ft., with a 30 ft. drift at the bottom, all in ore. The quartz is heavily mineralized, carrying iron, copper, and galena. M. C. Christensen and C. Jones, of Igo, owners.

Balaklava Mine (Quartz).—It is 7 miles W. from Kennett, and comprises several claims. The vein courses N.W.; the width not yet established. It is on the same ore body as found in the Iron Mountain Mine, though not so extensive, and carries iron, copper, gold, and silver. New York Company, owners; — Weil, of Redding, Superintendent.

Bell Mine (Quartz).—It is on Sunny Hill, 7 miles W. from Ono, at an elevation of 2,900 ft. The vein, 4 to 6 ft. wide, courses N. and S. in porphyry. The ore is sorted and shipped. Developments consist of a cross-cut tunnel about 180 ft. long, thence turned north on the vein over 300 ft. and south 260 ft. From tunnel level to surface the ground is largely stoped out. J. Bell, of Shasta, owner.

Black Diamond Mine (Quartz).—See South Fork Mining and Milling Company.

Blackfoot Mine (Quartz).—It is 4 miles S. of Shasta, and comprises 1,500 by 600 ft. The vein courses N. and S., lying vertical between a porphyry hanging- and slate foot-wall, very variable in width—from 6 in. to 5 ft. The quartz carries 0.5 per cent of sulphurets, which are hand-sorted and shipped. Developments consist of a 45 ft. shaft sunk on the

vein, and drift at bottom 40 ft. to the south and 31 ft. to the north; the south drift has been stoped to within 10 ft. of the surface. W. A. Boswell, of Shasta, owner.

Black Prince Mine (Quartz).—See South Fork Mining and Milling Company.

Black Spider Mine (Quartz).—It is near Shasta, and contains 1,500 by 380 ft. The 8 ft. vein courses N. 63° E., dipping 72° N.W., between greenstone and porphyry walls. The quartz carries 5 per cent of sulphurets, mostly iron and copper. Developments consist of a shaft 40 ft. on the foot-wall side of the vein, and some surface cuts. It cost $10 a foot to sink the shaft. A blower is required for ventilation. J. Bell and J. Scranton, of Shasta, owners.

Blue Bird Mine (Drift).—This claim of 20 acres is half a mile S. of Igo. The average depth of the gravel is 35 ft., with 40 ft. of lava capping on the west side. The main tunnel, 120 ft. long, is partly in granite bedrock. The course of the channel is N. and S., with 10 ft. of pay gravel, carrying coarse gold worth $17 per ounce. Next to the bedrock the bowlders are very large. The Dry Creek Water Company furnish the water. Only a few boxes are used for washing, which are cleaned up monthly. T. White, of Igo, owner.

Centennial Mine (Quartz).—See Niagara.

Central Mine (Quartz).—See our VIIIth Report, p. 565. This is 8 miles N. of Redding, and comprises three claims. The vein courses N. and S. and dips 80° E., between porphyritic walls from 1 to 4 ft. apart. The quartz carries 5 per cent of sulphurets. Developments at present are confined to a lower main tunnel, cross-cutting 956 ft., thence turned 431 ft. on the vein, giving 350 ft. of backs. Half a mile from the mine, near the river, are two Huntington mills and eight Frue vanners run by a 40 horse-power engine. Timbers are delivered at the mine for 6 cents per running foot, and cordwood (pine and oak) for $4 per cord. Whitehouse, Bliss et al., of Shasta, owners.

Cleveland Mine (Quartz).—See Eureka Tellurium.

Clipper Gold Mine (Quartz).—This is 8 miles W. of Kennett, and comprises nine claims. The vein courses N. 80° W. and dips about 50° N., with a width varying from 1 to 12 ft., in porphyritic rock, the quartz carrying 1½ per cent of sulphurets. Developments consist of a shaft with drifts every 50 ft. down to the 150 ft. level, and two tunnels, one of which cuts the shaft. Ore at present comes from the second level. The 10-stamp steam mill has two Woodbury concentrators. A Hallidie tramway conveys the ore 1,500 ft. to the mill. W. V. Huntington et al., of Kennett, owners.

Colorado Mine (Quartz).—This claim is 2 miles S.W. from Shasta, and comprises 1,500 by 600 ft. The 3 ft. vein courses E. and W. and dips 55° S., between porphyry and granite walls. The ore carries large masses of ferruginous quartz, also a considerable percentage of sulphides. E. P. Connor, of Shasta, owner.

Colorado Mine (Quartz).—See Remonia.

D & B Mine (Quartz).—See Remonia.

Deakin & Taylor Mine (Quartz).—It is 1½ miles S.E. of Shasta, and comprises 105 acres of land, containing the *Spanish*, *Taylor*, *Enright*, and *South* veins. The Spanish vein, 3½ ft. wide, courses E., and is nearly vertical, with granite hanging-wall and slate foot-wall. There

is a 210 ft. tunnel run on the ledge, also a shaft 45 ft. deep. The quartz carries 1½ per cent of sulphurets.

The Taylor lode, 2½ ft. wide, has an E. and W. course, dipping 70° N. between granite and porphyry walls. The quartz is sorted and shipped, and carries 2½ per cent of sulphides. The vein has been opened by 200 ft. of tunnel and a shaft sunk 65 ft.

The South vein, 4 ft. wide, runs E. and W. and dips 50° N., between granite and porphyry walls. The vein carries a good deal of "gossan"; the ore is high grade. There is only a 12 ft. shaft on this vein.

The Enright vein, 2 ft. wide, courses E. and W. and dips 50° N., between granite and porphyry walls. F. H. Deakin and T. G. Taylor, of San Francisco, owners.

Denver Mine (Quartz).—See Remonia.

Doeblein's Claim (Hydraulic).—This is 2 miles E. of Igo, comprising 200 acres. The bank consists of 14 to 25 ft. of gravel, with a lava capping of 100 ft. The slate rim rocks are 1,500 ft. apart; the channel has a N.E. and S.W. course. The gold is coarse and scaly; richest near the bedrock. Water is caught in reservoirs and brought to the claim through 6 miles of ditch, using 2,000 ft. of 8 in. pipe and a giant with 1 in. nozzle, under 100 ft. pressure. For washing, 200 in. of water are used, and 20 boxes paved with block riffles. G. Doeblein, of Igo, owner.

Dolcsath Mine (Quartz).—This claim, 1,500 by 600 ft., is 2 miles E. of Shasta. The course of the 2½ ft. vein is E. and W., dipping 75° S., between porphyry walls. The ore carries about 1 per cent of iron and copper sulphides. Developments consist of a 24 ft. perpendicular shaft, with an east drift. H. A. Wiser and J. Hill, of Shasta, owners.

Dreadnaught Mine (Quartz).—This claim, 1,500 by 600 ft., is 3 miles N.W. of Shasta. The 2½ ft. vein courses E. and W. with a dip of 80° N., between porphyry walls. The quartz carries 0.5 per cent of sulphurets, chiefly iron and copper. The quartz is worked in a 10 ft. arrastra, run by water from South Fork of Spring Creek; 1 ton is crushed per day, the water lasting four months. The developments are a 40 ft. tunnel and 20 ft. shaft, both on the vein. A. T. Molin, of Shasta, owner.

Eastern Star Mine (Quartz).—It is 14 miles S.W. of Redding, and consists of three claims. Connected with it are two other claims, known as the *Molly Maguire* and *Jim Blaine*. The veins course N.E. and S.W., dipping nearly vertical, between slate and porphyry walls. The Eastern Star vein is 4 ft. wide; the other two from a few inches to 1 ft., the quartz carrying a heavy percentage of sulphurets. Developments consist of a shaft 96 ft. deep on the Eastern Star, and on the others a tunnel 250 ft. long and a shaft 30 ft. deep. These veins make considerable water. J. W. George, of Igo, owner.

Edna B Mine (Quartz).—It is 4 miles N.W. of Redding. The course of the 3 ft. vein is a little E. of N. and dips 45° E., between porphyry walls. The ore carries a good percentage of sulphurets. Developments include a shaft 100 ft. deep, tapped by a tunnel 125 ft. long. The ore shoot found near the surface has not been cut by the tunnel. James Beecher, of Anderson, owner.

El Dorado and Eureka Mine (Quartz).—It is 12 miles N.E. of Shasta, and comprises 3,000 by 600 ft. The vein courses N.W. and S.E., dipping 45° S., with a width of from 3 to 20 ft., between slate and porphyry walls. The slate belt here is 3 miles wide. This is a new prospect. E. P. Connor, of Redding, owner.

Emigrant Mine (Quartz).—This claim, 1,500 by 600 ft., is 7 miles from Stella. The vein courses N.E. and S.W., and lies along the contact of the slate and porphyry, averaging 2 ft. in width. The quartz carries about 1 per cent of sulphurets of a good grade. Three tunnels are run on the vein, 160, 300, and 70 ft. long. C. A. Crowell, of Stella, owner.

Enright Mine (Quartz).—See Deakin & Taylor Mine.

Ethel Mine (Quartz).—This claim, 1,500 by 600 ft., is 14 miles S.W. from Redding. The 4 ft. vein courses N. and S., with vertical dip, between porphyry and quartzite walls. The quartz carries a heavy percentage of sulphurets. Developments consist of a 100 ft. cross-cut to the vein, a 20 ft. drift on the vein, and a 16 ft. winze. E. C. Norris and John Sparks, of Igo, owners.

Eureka Tellurium Mine (Quartz).—This is 2½ miles W. of Redding, on the N.W. corner of the Redding grant, along the Sacramento River and Salt Creek, comprising 290 acres. Four claims have been opened, known as the *Eureka Tellurium*, *Cleveland*, *Shaefer*, and *Herbert*. On the first a tunnel has been driven 600 ft. in a S.E. direction, cutting a 3 ft. vein, coursing N. 25° E., and pitching 60° S.E. This vein carries considerable calcspar and telluride ores, and is inclosed in metamorphic slate. An upraise 175 ft. on the incline connects with the surface; 90 ft. beyond, a second parallel vein is cut by the main tunnel; 400 ft. above, on the slope of the hill, an incline is sunk 99 ft. on the pitch of a 7 ft. vein, connecting at 58 ft. with a perpendicular shaft 74 ft. deep; from this a cross-cut has been run to the vein. The ore carries tellurides and about 1½ per cent of iron pyrites. A 10-stamp mill, with 850 lb. stamps, 8 ft. of apron plates, and two Woodbury concentrators, stands at the mouth of the main tunnel. These, and a compressor for two Phœnix machine drills, are run by a 40 horse-power engine. Peter J. Sherer, of Redding, Superintendent.

Falls Gold Mine (Quartz).—This is 4 miles W. from Igo, and comprises five claims, embracing a series of high-grade veins in the granite, varying from 3 in. to 2 ft. wide, and having a general N.E. and S.W. course. Developments consist of a number of small tunnels on the vein, from which the ore is sledded to a Tustin pulverizer, working 4 tons per day; thence it passes over a McGrew concentrator. The concentrates are worked by the barrel chlorination process, and both gold and silver are saved. The works are run by water power. E. L. Ballou, of Igo, owner.

Florida Mine (Quartz).—This claim, 1,500 by 600 ft., is 3 miles S. of Shasta. The 4 ft. vein courses E. and W. and dips 60° N., between porphyry and slate walls. The quartz shows a heavy percentage of iron sulphides, which are hand-sorted and shipped. Developments consist of two shafts, 600 ft. apart, 175 and 30 ft. deep; the former tapped by a tunnel 175 ft. long. Paying ore extends between both shafts. The mine makes 10,000 gallons of water per day. G. W. Boswell, of Shasta, owner.

Gladstone Mine (Quartz).—See our VIIIth, Xth, and XIth Reports, pp. 568, 637, and 45. This is in Kline's Gulch, 5 miles N.E. of French Gulch, and comprises six full claims. The vein courses N. 63° E., between a slate foot-wall and a porphyry hanging-wall. The quartz varies from 18 in. to 30 ft. in width, and what is unusual, the value per ton in gold increases with the width. The property is extremely well

situated for development through tunnels, of which there are five main ones, from 80 to 200 ft. apart; all are connected, enabling the tapping of the vein on the Carson claim, for instance, 900 feet below the apex. The principal working tunnel, the Ohio, cross-cuts the country 1,400 ft., and turns 300 ft. on the vein, exposing in the drift from 6 to 14 ft. of quartz, carrying about 1 per cent of sulphurets (iron and copper), also a little galena. About 25 in. of water issues from the tunnels. The reduction works consist of a 20-stamp mill run by water power four months in the year, and by a 140 horse-power engine the remainder of the time. There are four double Frue concentrators, besides two rockbreakers, self-feeders, etc. The stamps weigh 850 lbs. each, and have a duty of 2½ tons per stamp, when using No. 40 punched screens, and from 4½ to 6 in. drop, making 95 drops per minute. The apron is 4½ by 10 ft., set to a grade of 1 in. to the foot. The entire works are lighted by electricity. Electric bells are used in the lower workings. The water power is derived from Kline's Gulch through a ditch 1 mile in length. Owned in Cleveland, Ohio.

Green Mine (Quartz).—This is 3½ miles W. of the town of French Gulch, and comprises 4,500 by 600 ft. The vein courses N. and S., and dips 45° E., with an average width of 2 ft., between a slate hanging-wall and porphyry foot-wall. The quartz carries 1 per cent of sulphurets. Developments consist of three tunnels: 600, 400, and 360 ft. on the ledge. Nos. 1 and 2 are connected, and from No. 2 to the surface the greater amount is stoped. The tunnels are, respectively, 160, 1,000, and 200 feet apart, giving nearly 500 ft. depth from the surface to the lower level. The ore is hauled half a mile to the mill, at an expense of 40 cents a ton. A 5-stamp steam mill reduces the ore, which passes through a rockbreaker and roller ore-feeder. The stamps are run at 85 drops, on a 5 in. drop and 8 in. discharge, crushing 1½ tons to the stamp through a No. 10 slot screen. The apron plate is 10 ft. long, set to a grade of 1⅝ in. to the foot, with an equal length of sluice plates 24 in. wide. A Frue concentrator gathers the sulphurets. The plates are scraped once a day, and the battery, which is supplied on the inside with front and back plates, is cleaned up once a month. Two thirds of the amalgam by weight, but 75 per cent by value, is taken from the battery, as against one third and 25 per cent from the outside plates. The power is derived from a 25 horse-power engine, consuming 1½ cords of wood per day; cordwood costs $2 25. There is a possibility of running by water during five months in the year. The ground in the mine requires substantial timbering. Kelly, Frank & Co., of French Gulch, owners.

Gypsy Gold and Silver Mine (Quartz).—This claim, 1,500 by 600 ft., is 2 miles S.W. from Shasta. The 4 ft. vein courses E. of N., with vertical dip, between granite and diorite walls. Developments consist of a 50 ft. shaft on the vein and a drift started at 25 ft.; also two open cuts. J. B. Timmonds, of Redding, owner.

Hardscrabble Mine (Hydraulic).—It is at Igo, and comprises 1,720 acres, only a portion of which is gravel. The bank is from 20 to 80 ft. high, and the gravel contains about 25 per cent of bowlders and cobbles. It carries fine gold, worth $17 per ounce. Twenty-five acres have been worked. Hober and Eagle creeks and South Fork of Clear Creek furnishes the water through 25 miles of main ditch, which carries 1,300 in. of water. The property is idle at present, not having placed any

restraining dams for the debris. Merchants Exchange Bank, of San Francisco, owner.

Hartman Mine (Quartz).—This claim, 1,500 ft. by 600 ft., is 3½ miles N. of Whiskytown. The vein courses N.E. and S.W. with a N.W. dip, between porphyry walls about 2 ft. apart. Developments consist of two tunnels about 50 ft. long, driven on the vein, and a 45 ft. shaft. W. Hartman, of Stella, owner.

Herbert Mine (Quartz).—See Eureka Tellurium Mine.

Hidden Treasure Mine (Quartz).—This property, 6,000 by 600 ft., is 8 miles N.E. of Shasta, on the road to Iron Mountain. The vein courses N. 85° E., dips 70° N., and varies from 10 in. to 7 ft. in width, between quartzite and porphyry. The ore carries less than 1 per cent of sulphurets, mostly copper, and is said to contain some telluride. Developments consist of two cross-cut tunnels, 80 and 318 ft. long and 110 ft. apart perpendicularly, starting from Slick Road Gulch. The first is turned at 100 ft. on the vein and has an upraise of 60 ft. The second is turned at 100 ft. and runs 90 ft. E. on the vein. Both are connected, and an intermediate drift has been started. Some stoping has been done above the upper tunnel. The ground costs $10 per foot to drive through. The property includes a 10-stamp mill, with aprons 10 ft. in length, and a Johnston concentrator, run by a 4 ft. wheel with Pelton buckets, under 200 ft. pressure. The water is obtained from Slick Road Creek, being only sufficient for 5 stamps in summer. D. Jennings, of Craig, Ill., owner.

Honeycomb Mine (Quartz).—See Niagara.

Hull & Murray Mine (Quartz).—This claim, 4,000 by 600 ft., is 4 miles N. of Shasta. The vein courses N.E. and S.W., dipping 45° N., in porphyry. The ore carries 1 per cent of iron and copper pyrites. There is a 100 ft. tunnel on the vein and a perpendicular shaft 76 ft. deep. Hull, Murray et al., of Redding, owners.

Iron Mask Mine (Quartz).—It is 6½ miles from Whiskytown (Stella P. O.), and comprises six claims. Only two of these, the *Iron Mask* and *Pluto*, have developments. The vein is on a contact having a N.E. and S.W. course. Several tunnels are run, some on the vein and others cross-cutting. On the Iron Mask proper is a 200 ft. tunnel on the contact, as well as two other tunnels, respectively 200 ft. and 130 ft. in length. On the Pluto claim are two cross-cut tunnels, 60 and 100 ft. in length, which have not yet reached the vein. The property has a 5-stamp mill 3½ miles from the mine, on Clear Creek, at foot of Grizzly Gulch, which is run by water from Clear Creek. The quartz carries some sulphurets of a good grade. S. W. Levy, of San Francisco, owner.

Jay Eye See Mine (Quartz).—This is 4½ miles N.E. from French Gulch, and comprises four full locations. The fissure vein courses N. 63° E. and dips 60° to 75° N., within slate walls, the vein running against the course of the slate. The width of the quartz is from 8 in. to 4 ft. Developments comprise a shaft 4 by 6 ft., and 38 ft. deep; a cross-cut tunnel 146 ft. long, cutting an 18 in. vein, which is drifted on 160 ft. E. and 125 ft. W., showing in the breast a vein from 18 in. to 2 ft. in width, with 160 ft. of backs to the surface. Also a 90 ft. winze with short drifts both ways. A second cross-cut tunnel, 375 ft. to the vein, through slate rock, is turned 75 ft. E. on the vein and 60 ft. W., showing a 4 ft. vein on the face, and giving 236 ft. of backs. About 6 in. of water runs from this tunnel. An upraise 130 ft. long connects

tunnels Nos. 1 and 2 with an intermediate tunnel 30 ft. above No. 2, which is turned both E. and W., showing the vein to be 1 to 4 ft. wide. There is no mill on the property, but water power under 150 ft. pressure is obtainable during six months in the year for 10 stamps. G. W. Vanmeter et al., of French Gulch, owners.

Jim Blaine Mine (Quartz).—See Eastern Star.

Jim Fisk Mine (Quartz).—This claim, 1,500 by 600 ft., is in Muletown, 3 miles N. of Igo. The vein courses N. and S. with a slight dip to the W., between granite walls, with an average width of 1 ft. Developments consist of a shallow shaft and a small tunnel run to intersect it; these show quartz carrying considerable ochre, rich in free gold, which is sorted for shipment. The mill is an invention of one of the owners, and consists of a self-feeder with jarring motion, supplemented by a small stream of water conveying quartz into an upright iron cylinder 16 in. in diameter and 2 ft. high, with concave bottom, having a small cone in the center. At the circumference is a grooved iron ring, into which fits an iron curved shoe fastened at one end by an iron arm to an upright shaft, revolving by the means of a spur-geared wheel making 150 revolutions per minute. This shoe, which is 12 in. long and weighs 18 lbs., is forced into the groove of the iron ring by centrifugal force, grinding the ore. Eight inches above the bottom of the cylinder is an annular No. 60 brass wire screen 4 in. high. A ¾ in. iron pipe surrounds the cylinder on the inside below the screen, through which the exhaust steam from the engine is led. The pulp on leaving the screen is conducted into a copper cylinder 18 in. high and 1 ft. in diameter, amalgamated with quicksilver on the inside, where it is kept in rotary motion by a stirrer. After passing through two of these cylinders the pulp is allowed to escape. Both cylinders as well as the crusher are charged with quicksilver, and from a vessel placed above the feeder drops of cyanide of potassium solution are introduced into the mill; sodium is also added to the quicksilver. The mill crushes 2½ tons of rock in twenty-four hours. The power is furnished by a small 6 horse-power steam engine with upright boiler, consuming one fourth of a cord of wood. The machine is an experimental one, and is to be altered in some of its features, but appears to do fair work. E. Jones and H. C. Christensen, of Igo, owners.

Jumbo Mine (Quartz).—See Niagara Mine.

Last Chance Mine (Quartz).—This claim, 1,500 by 600 ft., is 2½ miles N.E. from Igo. The 2½ ft. vein courses N.E. and S.W., dipping 70° W., with slate and porphyry walls. E. C. Norris and John Sparks, of Igo, owners.

Lava Bed Mine (Drift).—This is 5 miles S.W. from Redding, and comprises a tract of 40 acres in Oregon Gulch, in Sec. 15, T. 31 N., R. 5 W. About 12 ft. of lava capping overlies 2 to 4 ft. of gravel, with an average width of 100 ft. The gravel is dark and tight, carrying fine gold, worth $16 75 per ounce. A tunnel has been run, partly in the bedrock, 250 ft., and the gravel breasted out 100 ft. wide and from 3 to 4 ft. high; timbered with posts and caps; 300 ft. of the channel has been worked. The mine makes about 600 gallons of water per day; 30 inches of wash water are obtained from Irish Gulch, being conveyed through 3 miles of ditch. Seven boxes are used, paved with slat riffles set on an 8 in. grade to the box. The water season lasts from December to March. A. L. Parsons, of Redding, owner.

Lodi Mine (Quartz).—It is 4 miles W. from Igo, and comprises two claims. The 6 in. vein courses N. and S. and dips about 35° E., between granite walls; it carries a large percentage of lead and iron sulphurets. Developments consist of a 60 ft. shaft and two tunnels about 35 ft. in length; no mill. W. D. Bull, of Igo, owner.

Lost Buck Mine (Quartz).—This claim, 3,000 by 600 ft., is 6 miles N.W. from Ono. The vein courses N.W. and S.E. and dips 15° E.; has a width of 8 in. to 2 ft.; the walls are micaceous schist; the quartz carries some sulphurets. Developments consist of a tunnel on the vein 200 ft. in length, giving 85 ft. of backs; stoped nearly to the surface. H. Arkarro, of Ono, owner.

Mad Mule (*Banghart's*) *Mine* (Quartz).—It is 5 miles N.W. of Whiskytown, and comprises 4,500 by 600 ft. Peculiar features are connected with this pocket mine, located on a porphyry dike from 50 to 300 ft. wide; the pay being in connection with black slate that lies folded and crumpled in the porphyry, and is traversed with seams of quartz. The apex of the upper curve of the folding seams carry the most gold when the quartz butts up to the porphyry. As high as $10,000 has been taken out of one of the contact points; the gold is coarse, adhering to quartz pieces, and is sold at $17 25 per ounce. The mine is worked by tunnels starting from Mad Mule Gulch on different levels along the contact of the dike, following the general N.E. course of the porphyry. The ore is washed, and worked up with a large hand mortar and spring-pole pestle. The tunnels furnish the necessary water for washing the ore. Elleigh & Rea, of Stella, owners.

Mad Ox Mine (Quartz).—This is 5 miles N. from Stella (Whiskytown), and embraces 4,500 by 600 ft. The 4 ft. vein courses N. and S., with nearly a vertical dip, between slate and quartzite, and carries high-grade ore. Developments consist of a main cross-cut tunnel 1,600 ft. in length to the vein. The tunnel cost $19,000, and reaches a depth of 700 ft. on the vein. L. Reil and J. W. Woodward, of Stella, owners.

Mammoth Mine (Quartz).—See our VIIIth Report, p. 568. This is 8½ miles N. of Redding, and comprises two claims. The vein runs N.W. and S.E., and a tunnel for prospecting purposes is being driven. S. Cheney, of Philadelphia, owner.

Manlove Mine (Quartz).—This claim, 1,500 by 600 ft., is 3½ miles N. of Whiskytown. The vein courses N.E. and S.W. with a N.W. dip, between porphyry walls about 2 ft. apart. Developments consist of a 45 ft. shaft and two tunnels about 50 ft. long, driven on the vein. J. E. Manlove, of Perkins, Sacramento County, owner.

Mascot Mine (Quartz).—This claim, 1,500 by 600 ft., is 2 miles W. from Shasta. The 4 ft. vein courses N. and S. and dips 60° W., between porphyry and granite walls. A tunnel is driven 100 ft. on the vein, the first 40 ft. being timbered. W. Herron, of Redding, owner.

Mechado Claim (Quartz).—This claim, 1,500 by 600 ft., is 3 miles N.E. from Igo. The vein courses N. and S. in granite, dipping vertical. The quartz carries 10 per cent of sulphurets. Developments consist of two shafts sunk on the vein about 14 ft. deep. — Mechado, of Igo, owner.

Miner's Dream Mine (Quartz).—This is 3½ miles S. from Shasta, and comprises 1,500 by 600 ft. The 4 ft. vein courses E. and W. and dips 50° N., between a slate hanging-wall and porphyry foot-wall. The developments are meager, consisting of a 40 ft. shaft sunk on the vein and 40 ft. of drift at the bottom, with about 30 ft. in length partly

stoped. The quartz carries some iron and copper sulphides. W. A. Boswell, of Shasta, owner.

Minnesota Mine (Quartz).—See Rattler.

Mocking-Bird Mine (Quartz).—This claim, 1,500 by 600 ft., is 14 miles S.W. of Redding. The vein courses N.E., dipping slightly E., and is from 4 to 22 in. wide, in syenite. The developments consist of a perpendicular shaft 80 ft. deep, and at the 40 ft. level two short drifts 20 ft. in length. W. Dunham, of Igo, owner.

Molly Maguire Mine (Quartz).—See Eastern Star.

Murray Mine (Quartz).—This claim, 1,500 by 600 ft., is 2½ miles S.W. from Copely. The 18 ft. vein courses E. and W., dips 50° S., with syenite hanging-wall and porphyry foot-wall. Developments consist of a tunnel 400 ft. long from the south; at 150 ft. it strikes the vein and turns on the same; two winzes of 25 ft. are started on the tunnel level. The ground above is stoped. Ventilation is secured by fire blast. A fine water power of 200 ft. pressure can be had. Barney Conroy, of Redding, owner.

Nelson Gold Mine (Quartz).—This claim, 1,500 by 600 ft., is 7 miles N. of Stella, on Grizzly Gulch. The vein courses N.E. and S.W. on the contact of the porphyry and slate, and carries from 1 to 2 ft. of quartz. Developed by two tunnels 600 ft. apart, driven on the vein. C. A. Nelson, of Stella, owner.

Niagara Mine (Quartz).—See our Xth Report, p. 636. It is 5 miles W. of French Gulch, on the south fork of the gulch, and comprises twenty-two patented claims, including 320 acres of timber land. Seven of the claims, known as the *Niagara*, *Scorpion*, *Summit*, *Centennial*, *Honeycomb*, *Jumbo*, and *Shea*, have been more or less worked. At present the works are principally on the Niagara, Scorpion, and Summit. The veins course E. and W. and dip 70° N., along the contact of slate and porphyry, having an average width of 2 ft. The ore carries 2 per cent of sulphurets. A ferruginous ore exists in the Niagara, showing few sulphurets and very little free gold with the horn, but which assays from $500 to $1,100 per ton in gold. This grade of ore is all shipped. The recognizable sulphides are iron and galena. The gold sells for $16 50 per ounce, but it has been noted that in going west the quality of the gold improves.

On the Niagara are four main tunnels cross-cutting to the vein. No. 1 is 662 ft. to the vein; No. 2 (the O'Neil) is 1,098 ft.; No. 3, 185 ft., and No. 4, 441 ft. The ore shoot here has a length of 180 ft., and has been proved 400 ft. deep. The Scorpion and Summit veins are each opened by three tunnels.

On the Niagara claim is an 18-stamp and on the South Scorpion a 10-stamp mill, both supplied with Frue concentrators and run by steam; at present only 10 stamps are dropping. These are speeded to 85 drops per minute, with a 6 in. drop and 7 in. discharge through a No. 40 mesh screen. The aprons are 10 ft. long and have 1¼ in. grade to the foot; the sluice-plates, 15 by 2 ft., are somewhat flatter. W. T. St. Aubyn, of French Gulch, Superintendent.

North Star Mine (Quartz).—This claim is 1,500 by 600 ft., and is 2¼ miles N.E. of Igo. The 3 ft. vein courses N. 20° E. and dips W., in slate walls. The developments are a 90 ft. shaft on the vein and a cross-cut. The quartz carries a large percentage of sulphurets.

Original Gravel Mine (Drift).—This is half a mile W. of Centerville, and comprises 100 acres. The owners are sinking through sandstone to strike gravel beneath on bedrock. A circular shaft, now 45 ft. deep, is being carried down through the sandstone, which is assuming a conglomerate nature. J. P. & E. Rathbun, of Colusa County, owners.

Original Quartz Hill Gold Mine (Quartz).—This is 4½ miles N.E. of Redding, near the Sacramento River, comprising three claims, designated the *Quartz Hill, Storm,* and *Snow.* The Original Quartz Hill Mine consists of two parallel lodes, whose croppings are 98 ft. wide, of solid quartz, and 1,200 ft. long, forming a hill 125 ft. higher than the surrounding country, with a pay shoot 622 ft. long. The "main lode," with the parallel "red ledge," which is blind, courses in conformity with the metamorphic slate country rock N. 40° W., but varying in the dip, dipping east for the upper 113 ft., then west. A tunnel 168 ft. long cuts the main ledge 75 ft. below the surface, passing for 74 ft. through metamorphic slate, then crossing the red ledge 25 ft., and through 28 ft. more of slate into a gouge from 5 to 8 ft. thick, and 36 ft. of quartz of the main ledge. From this level an incline was sunk 47 ft. in the hanging-wall gouge, disclosing a 5 ft. quartz vein coming in from the east at a depth of 24 ft., where the dip changed. From the bottom of the incline a cross-cut run west cuts the main lode at a total depth of 112 ft. The main lode carries along the center from 5 to 6 ft. of high-grade quartz, separated from the rest by a casing of talcose schist, in which wire gold is found. The dimensions of the pay shoot as far as explored are, on the "red ledge," 333 ft. long, 25 ft. wide, and 112 ft. deep; on the "main lode," 622 ft. long, 30 ft. wide, and 112 ft. deep. A steam Burleigh drill is being put in place to work the outcrop on the southwest end in benches (quarrying), the quartz being conveyed over a tramway 3½ miles in length to the 34-stamp mill on the Sacramento River, which consists of two 12-stamp, iron, circular batteries, and two 5-stamp batteries, with aprons 5 by 10 ft., set on a 1¼ in. grade to the foot, four Frue vanners, and two canvas tables 20 ft. long and wide, divided into ten sections each. The bullion is .603 fine in gold and .378 in silver. The motive power is water, brought through 7 miles of ditch and flume and a 2,000 ft. pipe-line, reducing from 18 in. to 15 in., and bridged across the Sacramento River, working under a 220 ft. pressure on an 8 ft. Knight wheel. M. Maryanski, of Middle Creek, Superintendent.

Pluto Mine (Quartz).—See Iron Mask.

Potosi Claim (Quartz).—This is 12 miles S.W. from Redding, and comprises 3,000 by 600 ft. The 15 in. vein courses N. and S., with a westerly dip; the walls are a syenitic granite; the quartz high grade. Hon. John P. Jones, of Gold Hill, Nevada, owner.

Pugh & Lindsay Mine (Quartz).—This claim, 6,000 by 600 ft., is 3 miles W. from Shasta City, on Clear Creek, and has three parallel veins, coursing E. and W., with a dip of 55° N., and a fourth vein with a N.E. and S.W. course, all in quartz porphyry, and averaging 18 in. to 3 ft. in width. Developments consist of a shaft 60 ft. deep on one of the veins, a tunnel 60 ft. in length on another, and a tunnel 40 ft. long on a third vein. The quartz carries 0.5 to 1 per cent of sulphurets. The reduction works comprise a Kendall rocker mill, with a duty of 6 tons per twenty-four hours when using No. 9 or 10 screens, and rocking twenty-eight times per minute. Pugh, Lindsay et al., of Shasta, owners.

Rattler (Minnesota) Mine (Quartz).—See our Xth Report, p. 635. It is 3½ miles W. of Copely, and comprises two full claims, besides 160 acres of timber land. The course of the 5 ft. vein is E. and N., dipping 80° N., between trap and slate walls. There are four tunnels; the upper, or No. 1, runs 280 ft. on the vein, which has been stoped both above and below it; No. 2, 105 ft. below, runs 35 ft., showing a 5 ft. vein in the breast; No. 3, 174 ft. below No. 1, has been driven 125 ft., connecting at the breast through an incline with No. 4, or main tunnel, which is 1,200 ft. long and shows at 1,100 ft. a ferruginous cross-ledge carrying gold, and is 240 ft. below tunnel No. 1. The main tunnel is being driven ahead to cut the ore shoot that was stoped below No. 1 tunnel. The ore carries about 0.5 per cent of sulphides of iron and copper. The company controls three mountain streams that unite at the mine, giving a large water power. The plant consists of a small sawmill and a 10-stamp mill, with 850 lb. stamps, run by a 3 ft. Pelton wheel under 360 ft. pressure. The mill works with 6 in. drop, 90 per minute, using No. 40 screens. Parmelee Ore Concentrating Company, of Union Stock Yards, Chicago, Ill., owners.

Red Cloud Mine (Quartz).—This claim, 3,000 by 600 ft., is 4 miles N.W. from Igo. It is an E. and W. vein, 8 in. wide, dipping slightly to the N., in granite walls. The quartz carries a large percentage of sulphurets. The ore is sorted and shipped, the first-class ore bringing over $300 per ton. Developed by a cross-cut tunnel 50 ft. long and turned 50 ft. on the vein, giving about 50 ft. of backs. The freight charges on ore are $4 to the railroad and $9 to San Francisco. The gold is worth from $12 to $15 per ounce. Hubbard & Kingsbury, of Igo, owners.

Red Hill Mine (Hydraulic).—It is half a mile N.E. from Ono, and comprises 60 acres. This gravel belt extends in a S.W. direction, and can be traced for many miles; the underlying granite bedrock has a southerly pitch. The gravel bank averages 60 ft. in depth, carrying about 60 per cent of bowlders and cobbles, cemented near bedrock. It carries flat scale gold, worth $17 50 per ounce throughout, and is richest on the lower 10 ft. The bank has been subjected to heavy movements, as evidenced by slips and faults that have sheared big bowlders in two. Both east and west this gravel bed is overlaid with sandstone. The gravel bank is loosened by high explosive powder. The holes are drilled with a 7 ft. worm drill, operated by three men. It takes on an average twenty minutes to put down a 7 ft. hole, which is first "chambered" and then charged with seven sticks of powder.

The source of the water supply is the Dry Creek Tunnel and Fluming Company's ditch. The mine uses 100 in. of water, under 50 ft. pressure, brought through 1¼ miles of ditch, for which they pay from 3½ to 5 cents per inch, according to the season of the year. The water season lasts ten months. The sluices consist of six boxes, 2 ft. wide, set on a 6 in. grade to the box, paved with wooden blocks 6 in. thick. A clean-up is made every two weeks. For the retaining of the debris, which is dumped into Pan Gulch, there are five brush dams and a stone dam. The latter is 60 ft. long on top and 16 ft. on the bottom; 12½ ft. thick on bottom and 7½ ft. thick on top, and is below the others. About 500 in. of water could be obtained for four months in the year, and 100 in. for six months, by digging the necessary ditches. A "giant" with 4 in. nozzles and 450 ft. of 8 in. pipe is used. M. Gardiner, of Ono, owner.

Remonia Gold Mining Company (Quartz).—This is 4 miles S.W. of Redding, comprising three claims, known as the *Denver*, the *Colorado*, and the *D & B*. The course of the veins is N.E. and S.W., with a dip of 60° W., between granite walls; the width of the veins average 4½ ft., and are heavily sulphuretted. Developments on the Denver consist of a shaft 45 ft. deep, and two smaller ones 16 and 10 ft. deep; there is a 30 ft. shaft on the D & B vein.

Richmond Mine (Quartz).—It is 3½ miles W. of Igo, and comprises a full claim on a 2½ ft. vein, coursing N.E. and S.W., and dipping nearly vertical in granite, with 6 to 8 in. width. There are three shafts, 40, 60, and 80 ft. deep, with some drifting. The ore, which carries a large percentage of sulphurets containing silver and gold, is shipped. J. B. Wright, of Igo, owner.

Sacramento Pliocene Mine (Drift).—This is in Oregon Gulch, in Sec. 15, T. 31 N., R. 5 W., 5 miles S.W. from Redding, and comprises 1,200 by 1,200 ft. The gravel deposit, 2 ft. thick and 600 ft. wide, lies on a slate bedrock overlaid with about 70 ft. of sandstone. This gravel is dark colored, tight, with large bowlders on the bottom; the gold is on and in the bedrock. The property is opened with a perpendicular shaft 6 by 6 ft., 42 ft. deep; from the bottom a drift has been driven E. 125 ft. The mine is supplied with a 25 horse-power upright steam hoist, which has a 1½ in. Blake suction pump attached, running eight hours per day. The engine consumes one fourth of a cord of oak wood per day. Breasting and washing have not been commenced. Dr. L. A. McLane et al., of Sacramento, owners.

Salt Creek Group of Mines (Quartz).—They are on Salt Creek, 4½ miles N.W. of Redding, and are the following claims: The *Bonanza*, *Corinne*, *Jumbo*, *Gold Coin*, and *Phœnix*.

The Bonanza lies on the west side of the creek, parallel to and 400 ft. distant from the Corinne on the east side. A diorite dike lies between the two, and porphyry forms the opposite walls. These two veins have a N. and S. course and vertical dip. A shaft has been sunk 300 ft. on the ledge, which has an average width of 3 ft., with a gouge on both sides. A short tunnel of 30 ft. has also been run on the vein.

The Corinne, a N. and S. vein, has been exposed by an open cut along the apex. A tunnel 135 ft. long from the west cuts a 4 ft. vein, 20 in. of which carries a large percentage of high-grade sulphurets.

The Jumbo, an E. and W. vein pitching N., crosses the Bonanza and Corinne ledges. A 30 ft. shaft sunk on the vein, dipping W., passed through a pay shoot carrying very coarse free gold. A tunnel on the vein, to intercept the shaft, has been driven 40 ft. In the breast the vein is from 1½ to 2½ ft. wide.

The Gold Coin, the first extension southerly of the Corinne, has a 4 ft. vein, with two shallow shafts and 300 ft. of the outcrop stripped.

The Phœnix, east of the Corinne and Bonanza, is a N. and S. vein, 2½ ft. wide. The ore is disintegrated and carries coarse gold. Ten distinct pay shoots have been determined in these veins, carrying a small percentage of high-grade sulphurets. E. P. Conner, of Redding, owner.

Schuyler Mine (Drift and Hydraulic).—It is three fourths of a mile from Igo. The tunnel is 1,900 ft. in length. At 1,500 ft. in is an incline 280 ft. long. The ground is self-draining; the bedrock pitching S.E. Ventilation is secured by three air shafts from 48 to 66 ft. in depth. The breasts are from 30 to 100 ft. wide and carried 6 ft. high, with

single post and cap timbering, also partly rock filled. The hydraulic portion of the claim has a 55 ft. bank, worked with 75 ft. of water pressure, and uses twenty 2 ft. sluice-boxes set on a 5 in. grade, and paved with block riffles. There are two brush restraining dams and one stone dam on Dry Creek for the debris. Chinese Company, owners.

Scorpion Mine (Quartz).—See Niagara.

Shea Mine (Quartz).—See Niagara.

Snow Mine (Quartz).—See Original Quartz Hill.

South Vein Mine (Quartz).—See Deakin & Taylor Mine.

Spanish Vein Mine (Quartz).—See Deakin & Taylor Mine.

Spardy Mine (Quartz).—This claim, 1,500 by 600 ft., is on Flat Creek, 2½ miles S.W. from Copely. The 7 ft. vein courses E. and W., dipping 45° S., and is an extension of the Vanderver & Bullard, with syenite and porphyry walls. A cross-cut driven 450 ft. cuts the ledge, along which the drift has been run 500 ft.; the ground from there to the surface is mostly stoped. Barney Conroy, of Redding, owner.

Spellman Mine (Quartz).—This claim, 3,000 by 600 ft., is 3 miles S.W. from Copely. The 2 ft. vein courses E. and W., dipping S., between syenite walls. Developments consist of two tunnels on the vein, from the bank of Spring Creek, about 300 ft. in length. The quartz carries about 1½ per cent of iron and copper sulphides of good grade. J. Spellman, Joe Mott, and D. Haskell, of Redding, owners.

Spring Gulch Mine (Quartz).—This claim, 1,500 by 600 ft., is 7½ miles N. of Whiskytown. The vein, from 2 in. to 1 ft. wide, courses N. and S., with an easterly dip, in porphyry. Developments consist of three tunnels on the vein, one below another; No. 1. 40 ft., No. 2, 50 ft., and No. 3, 212 ft. long. An upraise from the lower tunnel is at present 40 ft. high. L. Riel and J. R. Woodward, of Stella, owners.

Storm Mine (Quartz).—See Original Quartz Hill.

Sugarloaf Mine (Quartz).—This is 4 miles W. of Redding, and comprises 20 acres. The 5 in. vein courses a little S. of E., with a vertical dip, between slate and quartzite, to a heavier lode running N. and S. Developments consist of a shaft 22 ft., sunk on the smaller vein, with a small drift. The quartz is mostly specimen rock, carrying some telluride with iron sulphurets, and is worked in a hand mortar. E. D. Hendrick et al., of Redding, owners.

Summit Mine (Quartz).—See Niagara Mine.

Sunny Hill Mine (Quartz).—This claim, 7 miles W. of Ono, is not being worked at present. The 4 ft. vein courses N. and S., with a vertical dip, between porphyry and slate walls. The ochery ore is sacked and shipped. The ore carries a large percentage of sulphurets. A 5-stamp mill and a 5 ft. Huntington roller mill, belonging to the property, are run by a 4 ft. turbine. The sulphurets are saved on blankets. The ore is hauled to the mill on sledges. Sharp Manufacturing Company, of Ono, owners.

Surprise Gold Mining and Milling Company (Quartz).—This claim, 1,500 by 600 ft., is 1¾ miles N. from Shasta City. The 12 ft. vein courses N. 58° E., between porphyry walls. A double-compartment shaft, at present 50 ft. deep, has been started in the wall a few feet from the vein. The quartz carries 1½ per cent of high-grade sulphurets. The mine makes 150 gallons of water per hour. Surprise Gold Mining and Milling Company, owners; J. Gilson, of San Francisco, Secretary.

Texas Consolidated Mine (Quartz).—See our Xth Report, p. 629. This is 8 miles N. of Redding, and comprises 519 acres. There are three veins being exploited; the main ledge, which has no outcrop, is about 8 ft. wide, and courses N. and S.; another vein is 380 ft. E., and another 125 ft. W. These have a dip of about 80° E., with good slate walls, and with gouge on both sides. The mine is opened by five tunnels, No. 5 being 1,500 ft. long on the vein and 910 ft. below the surface. The ore in the breast carries 2½ per cent of sulphurets, besides some tellurides. The ore shoot is over 600 ft. in length. An aerial tramway conveys the ore from No. 5 level over 1½ miles to the 20-stamp mill, on the Sacramento River. The mill contains 825 lb. stamps; a grizzly, with 1¼ in. apertures between bars; a rockbreaker; Hendy self-feeders, working from the center stamp; steel shoes and dies, and both front and back plates inside the battery. The duty of each stamp is 2 tons per day. A small 18 in. apron-plate delivers the pulp through a trap to a double sluice-plate, 18 in. wide and 20 ft. long; these have a grade of 1½ in. to the foot. Eight improved Triumph concentrators dispose of the concentrates, the tailings passing over a canvas plant of twenty sections, 24 ft. long, set on a grade of 7 in. for the entire length. The final tailings are reported as assaying 25 cents per ton. About 50 men are employed in the mine, and about 75 men through the entire works. The engine is of 50 horse-power, and 5 cords of wood are used per day. E. G. Hart, of Whitehouse, owner.

Thompson Mine (Quartz).—This claim, 1,500 by 600 ft., is 2½ miles S.W. from Shasta City. The course of the 3 ft. vein is a little N. of W. and dips 50° N., near the contact of granite and porphyry. An incline shaft, sunk about 80 ft., is intersected by a tunnel run 125 ft. on the vein. The ore is sorted and shipped. See our XIth Report, p. 40. — Thompson, of Shasta City, owner.

Uncle Sam Gold Mine (Quartz).—See our Xth Report, p. 629. This is 7 miles W. from Kennett, and comprises seven claims, besides two sections of timber land; employing 67 men in the mine, and 80 men altogether. The vein courses N. 80° W. and dips 55° N., with a parallel back vein about 100 ft. distant, both in porphyritic rock. The main vein shows a width of 6 in. to 10 ft; the back vein 2 in. to 6 ft. The quartz carries about 1½ per cent of iron and copper pyrites. The developments consist of several tunnels opening on the vein in different levels. No. 3 is the main working tunnel, from which the ore is conveyed by mule and horse power, five and six cars of 1½ tons each at a load, over a 1,700 ft. tramway flanking the hillside, to a double incline track 475 ft. long leading to the mill. No. 3 is a cross-cut for 1,200 ft., where it breaks into the vein at right angles and turns east on the vein 800 ft., and west 700 ft.; at the west end it shows 14 ft. of a vein, but is somewhat smaller at the east end. Three shoots have been developed on the main vein, pitching west, and one on the back vein. Three upraises connect No. 3 tunnel with the works above, which show a large amount of reserved ore well opened up. Between tunnels No. 3 and No. 2 the distance on the slope of the upraise is 440 ft.; thence to No. 1, 100 ft.; thence to the surface, 230 ft.

A compressor plant for three drills is operated by water power under 250 ft. pressure, as is, part of the time, the 30-stamp mill and Huntington roller mill with the four Triumph and ten Frue concentrators. The mill averages about 60 tons per twenty-four hours. A 60 horse-power engine runs the mill machinery part of the year.

A peculiar drop of the stamps is found here, being arranged 5, 4, 3, 1, 2, and feeding from No. 2 stamp, being placed a little farther from the end of the mortar than No. 5 at the opposite end. The number of drops is 92, with 5 in. drop and 6 to 7 in. discharge, using Nos. 40 and 45 slot burr screens; aprons have 1¼ in. grade.

A large canvas plant, consisting of two tables, 36 by 20 ft. and 24 by 20 ft., with 2½ ft. sections, is covered with drilling instead of canvas, and is found to do the work as efficiently. These tables are set on a grade of 1¼ in. to the foot.

The company chlorinate their own concentrates, and have a small double-hearth furnace, with a capacity of 2,400 lbs. in twenty-four hours, using chlorine gas direct and saving the gold only. The elevation at the office of the works is 2,025 ft. English Company, London, owners; W. M. James, of Kennett, Superintendent.

Utah and California Gold Mine (Quartz).—It is 7 miles N. of Redding, and comprises 400 acres. The vein, from 3 to 50 ft. in width, courses N. and S. and dips about 80° E., in porphyry walls. The ore carries a large percentage of sulphurets. The mine is developed through three tunnels—the Josephine, Emmeline, and Main tunnel. The Josephine is run on the vein and is 900 ft. long. The Emmeline, 70 ft. lower, is partially cross-cutting for 450 ft., then turned both north and south on the vein 700 ft. The Main tunnel is 1,100 ft. in length and 450 ft. below the surface at the breast, with 500 ft. drifted on the vein. An upraise to connect the tunnels is at present all the active work being carried out. Up to date 14,000 tons of ore have been extracted and milled. The ore shoot is 700 ft. in length. On account of the impossibility of extracting anything near the full value of the ore by the present milling process, and the heavy expense connected with the shipping and working of the ores at outside points, no pay ore is at present being stoped.

The company owns a 10-stamp steam mill, 1,400 ft. from the mine, on the Sacramento River, hauling the ore at a cost of 65 cents per ton. The mill is supplied with a No. 1 Blake crusher, Hendy self-feeders, and 1,200 lb. stamps, supplied with chrome steel cams, shoes, and dies; the life of the shoes is 90 days, with a duty of 2½ tons per stamp per day when working at 90 drops per minute, with 3½ to 5 in. drop, and 6 in. discharge, through a No. 35 slot-cut Russian iron screen. The batteries are provided with front and back inside plates, and 4 by 12 ft. aprons, set on a 1½ in. grade to the foot. The aprons, scraped daily, yield an equal amount of amalgam with the batteries. Cyanide of potassium solution and lye are used in the batteries and on the plates. Four Frue vanners save the sulphurets. The mill, when running, consumes 4 cords of wood per day (pine and oak), at a cost of $4 per cord. Timbers are delivered at 6 cents per running foot. The timbers in the mine do not last over three years.

Artificial ventilation for the main tunnel is supplied by suction, a furnace on the outside drawing the vitiated air through 1,500 ft. of pipe. Water for use in the mill is pumped from the river. Miners' wages are $2 50 per day; millmen receive $4. See our Xth Report, p. 630. J. R. and M. H. Walker, of Salt Lake, owners.

Vanderver & Bullard Mine (Quartz).—This claim, 3,000 by 600 ft., is 2½ miles S.W. from Copely. The vein courses E. and W. and dips about 45° S., between a syenite hanging-wall and porphyry foot-wall. The

quartz carries 1 per cent of copper and iron sulphides. Developments consist of a cross-cut tunnel 150 ft. to the ledge, and then turned on the course of the vein for 305 ft., giving 100 ft. of backs. Above, on the slope of the hill, two smaller tunnels run to the vein. In connection with the mine is a 3½ ft. Huntington mill, not running, with No. 60 slot screen and a 10 ft. apron 30 in. wide, supplied with a cross riffle every 14 in. Vanderver & Bullard, of Copely, owners.

Washington Mine (Quartz).—See our Xth Report, p. 625. It is 4 miles W. of French Gulch, and comprises 82 acres of patented land. There are two systems of veins on the property, a N. and S. and an E. and W.; the walls are porphyry and slate. The N. and S. vein dips 45° E., with a width varying from 1 to 8 ft. on the contact; the ore is low grade, with occasional short shoots of higher-grade ore. The E. and W. veins, of which four are known, are from a few inches to several feet in width and about 60 ft. apart. Timbers cost 5 to 7 cents per foot, and lagging 5 cents apiece. There is a 10-stamp mill with a capacity of 1 ton per stamp. See our XIth Report, p. 635. W. G. Van Meter et al., of French Gulch, owners.

West End Mine (Quartz).—This is 1 mile S. of Whiskytown, and comprises 1,500 by 600 ft. There are three veins on the claim; two course N. and S., while the third courses E. and W. The main N. and S. vein is 3 ft. wide, and the smaller one about 12 in., both between porphyry walls. The E. and W. vein is iron capped, about 8 ft. wide. They are sinking a double-compartment vertical shaft 4 by 8 ft. in the wall near the principal N. and S. vein, and is 60 ft. deep at present. Messrs. D. B. Hunt et al., of Stella, owners.

West Point Mine (Quartz).—This claim, 1,500 by 600 ft., is 3½ miles from Shasta. The 20 in. vein courses E. and W. and dips 55° N., between a slate foot-wall and a porphyry hanging-wall. Developments are a 40 ft. shaft and a tunnel which will tap the vein at about 160 ft. The hanging-wall side of the vein requires solid timbering. The gold in this section sells for $18 per ounce. G. W. Boswell, of Shasta, owner.

World's Fair Mine (Quartz).—This claim, 1,500 by 600 ft., is 2½ miles N.E. from Igo. The vein, from 3 to 9 ft. wide, courses N. 20° E., dipping slightly W., between slate and porphyry walls. Developed by a tunnel on the vein 130 ft. long, with 100 ft. of backs. The quartz carries a good percentage of sulphurets, largely iron. John Doeblein, of Redding, owner.

Yellow Jacket Mine (Quartz).—This claim, 1,500 by 600 ft., is 3 miles N.E. from Copely. The vein courses nearly E. and W., and dips nearly vertical. The walls are syenite and porphyry. The ore is high-grade quartz, carrying galena and iron pyrites. Developments to date consist of an open cut and 50 ft. of a cross-cut tunnel. W. Emerson and W. Slimmer, of Copely, owners.

SIERRA COUNTY.

The languishing of the mining industry during the past few years has been perhaps felt more severely in this county than anywhere else within the State, from the fact that only a small portion of its lands are suited for agricultural pursuits, and that the working of the large areas of auriferous gravels was hampered by the law. But aside from these facts, several of the oldest paying mines had reached a point where the

cost of production left too small a margin for profit, and the once extensive works, with their large busy crews, were being managed on a greatly reduced scale. The revival of mining throughout the auriferous belt of California is likewise beginning to penetrate into the mountains and deep cañons of the Sierra; foreign capital is investigating the possibilities of this section, and already some properties have changed hands and are being enlarged and placed on a firmer working basis. That there are still large possibilities for successful mining operations, nobody acquainted with the county and its mining record will dispute.

Alaska Mine (Quartz).—This property was mentioned in our VIth Report (Part II), p. 58. It is about one fourth of a mile N.E. of Pike City, and comprises four claims, making 52.88 acres; altitude, 3,800 ft. The vein courses N.E. with a vertical dip, between slate and porphyry walls, and has a width of 2½ ft. The quartz carries a small amount of low-grade iron sulphurets. The mine has lately been reopened and the intention is to run a deep drain tunnel to lessen the expense of pumping. The present drain tunnel intersects the shaft at a depth of 50 ft.; the new drain tunnel is started from Oregon Gulch and will cut the vein several hundred feet below the shaft, and will be the main working tunnel. Machine drills are to be used, and when completed the mill will be removed to its mouth. Alaska Mining Company, of San Francisco, owners; G. Lux, Secretary.

Alturas Mine (Placer).—See our XIth Report, p. 332. It is a tailings claim on Slate Creek, and extends 5½ miles N. from the La Porte and Port Wine crossing. The average depth of the gravel at present worked is 6 ft., though in places it is over 40 ft. A bedrock cut, one half mile long, has been blasted out, the course of the creek straightened, and extra fall obtained by tunneling through the projecting points; the whole having cost $20,000. A link-belt elevator is used to raise the gravel; water power, under 100 ft. pressure, acts on a Packer wheel, which is similar to a Pelton. Part of the channel contains rich virgin gravel. The gravel and tailings are washed through a series of boxes set on an 8 in. grade to the 12 ft. box, using cross and slat riffles. There are 25 men employed.

Atom Gold Mine (Quartz).—This is 4 miles N.E. from Camptonville, in Lincoln township, and comprises two claims. The vein courses E. of N., standing nearly vertical, between slate and porphyritic walls, with a width varying from 1 in. to 2 ft. The quartz contains a few iron sulphurets and some coarse free gold. The method of working has been confined to washing off the outcrop through sluices and piling up the quartz for future arrastra reduction. For this purpose 400 ft. of sluices are employed, 16 in. wide, with Hungarian riffles; 20 to 50 in. of water from Sleighville Ravine is used under 70 ft. pressure; the season extends over five months. E. C. Cochrane et al., of Camptonville, Yuba County, owners.

Bald Mountain Extension Mine (Drift).—See our VIIIth and XIth Reports, pp. 580 and 408. It is 2½ miles E. of Forest City. The present workings are down channel, requiring the sinking of an incline 130 ft. to a perpendicular depth of 30 ft., and the driving of a gangway on the course of the channel to cut the same, and so work this section up the stream. The water is cut off from the incline in the old works and hauled up in cars, holding 300 gallons each, to the main tunnel; they are loaded with the help of a Chinese pump worked by hand

power. Six cars of water are taken out on a shift. Work will shortly be resumed on the upstream or northern portion of the channel, where a considerable body of gravel remains untouched. It appears that a part of the lava channel runs alongside of the gravel channel, and may have cut through it.

At the head of the incline is a gasoline engine of 6 horse-power for hoisting. A tank of 24x24x8 ft. holds the wash water, and washing is done every time the tank fills. The dump holds several thousand carloads of 1 ton weight each; the present output is 60 cars per day, or 5 cars to each breaster. The head boxes are cleaned weekly, the remainder of the 500 ft. of sluices twice a year. Twenty men find employment around the works. Bald Mountain Extension Drift Mining Company, owners; R. Forbes, of Downieville, Superintendent.

Bigelow Mine (Quartz).—See our XIth Report, p. 413. It is a south extension of one of the Sierra Buttes veins, located in Sec. 28, T. 20 N., R. 12 E. The vein courses E. and W. and pitches very flat to the N. A feature of peculiar interest is the intersection of the ledge for a distance of 80 ft. by a lava dike. O. Bigelow, of Sierra City, owner.

Brandy City Mine (Hydraulic).—This is in Brandy City, at an elevation of 3,700 feet above sea-level. This channel has been extensively worked in former years. They are at present engaged in building flumes and dams in connection with their impounding works, for which purpose over 1½ miles of flume will have to be built to convey the debris to the pits where it will be retained. This flume will be 4 by 3½ ft., set on a 4 in. grade, and will deposit the debris in an old pit closed by a brush dam; the muddy water after settling passes through an old shaft and tunnel in the rim rock, into the North Yuba River. The present bank shows a height of 225 ft., with 50 ft. of lava cap, the gravel being largely composed of small quartz. Under the present contemplated workings only a part of this gravel can be worked. The present water supply is obtained from Cherokee Creek, and is delivered under 225 ft. pressure; they own a water right also on Hoosier Creek, but their flumes have been destroyed. The company own their own sawmill, which is engaged in sawing flume lumber, running night and day. The course of the Brandy City channel, which has been referred to by some parties as part of the Port Wine channel, is from W. to E., and has but little grade in the present pit. The bedrock is slate, and an outlet tunnel has been driven through to Cañon Creek, for which purpose the company used a compressor and two Burleigh drills. The channel averages about 500 ft. in width. The water is conveyed through a pipe reducing from 22 in. to 15 in. and to 9 in., and delivered by three "giants," with 5½ in. nozzles. The company use rock pavement and block riffles in their flumes; the latter are 22 in. by 14½ in. and 12 in. thick, costing $12 per thousand, board measure. The gravel is said to contain platinum. All freight has to be brought from Camptonville by pack animals, costing 1 cent per pound. Wages are $2 50 per day, and at present 25 men are being employed. Brandy City Hydraulic Mining Company, owners; J. Redington, of Camptonville, Yuba County, Superintendent.

Bullion (Fessler) Mine (Quartz).—See our XIth Report, p. 407. It is about 1 mile E. of Alleghany. The vein, supposed to be the same as the Plumbago, is being opened from the Minnesota side of the ridge; it has an E. and W. strike and a N. dip, with porphyry and serpentine walls. Developments consist of several tunnels along the outcrop of the vein.

The quartz carries arsenical pyrites, and is reduced in a hand mortar. J. Fessler, of Alleghany, owner.

Bunker Hill Mining Company (Drift).—This is 4 miles N.E. of Brandy City, on the Brandy City and Eureka ridge, and comprises 480 acres. Several tunnels have been run into the ridge by former companies, which are now partially caved. The present company is cleaning out one that starts into the ridge in an N. and S. course at an elevation of 4,450 ft. above sea-level, and it is now in 250 ft. At 100 ft. from the mouth gravel comes into the top of the drift and continues till within 50 ft. of the breast, when the bedrock again raises. This gravel is of a dark color, free, and prospects a little, the gold being of the coarse order and selling at $17 50 per ounce. Another tunnel, 40 ft. higher, cross-cuts to the gravel, but it is caved. At present one man is washing off the surface near Cherokee Creek below the tunnel, prospecting for evidences of a larger back channel, which is supposed to cross through this ground. On the slate bedrock quartz bowlders and coarse gold are found. Bunker Hill Mining Company, owners; H. A. Morse, of Downieville, Secretary.

Cedar Gold Mine (Quartz).—It is on Kanaka Creek, in the Alleghany District, and comprises 1,500 by 600 ft., with an E. and W. vein, between slate walls, near the serpentine belt. The pay shoots are short and quite rich where they approach the serpentine. J. Fessler, of Alleghany, owner.

Chips Mine (Quartz).—See our Xth and XIth Reports, pp. 652 and 402.

Cleveland Mine (Quartz).—This property was described in our Xth and XIth Reports, pp. 650 and 414. The drift is being extended and some prospect work being done. Cleveland Gold Mining Company, owners; J. Kain, of Sierra City, Secretary.

Clipper Ship Mine (Drift).—This is about 1½ miles S.E. from St. Louis. The channel runs N.E. and S.W., with from 2 to 12 ft. of gravel, the pay being confined to the lower half. The front part of the mine was worked as a hydraulic. A tunnel has been driven 1,000 ft. to strike the channel, and an upraise of 8 to 10 ft. it is thought will strike into the gravel. About 800 ft. of the channel has been worked. The tunnel is ventilated by a water-blast; an 11 in. pipe carries the air. Water is obtained from the Sierra Union Water Company, and costs 30 cents per inch per twenty-four hours for hydraulic purposes, and 40 cents per inch for twelve hours for washing the drift gravel in sluices. D. Conlan, of St. Louis, owner.

Colombo Mine (Quartz).—See our Xth Report, p. 648. It is 4 miles W. of Sierra City. The property is being worked by tributors, who are drifting between tunnels No. 1 and No. 2 on a fair grade of ore. The ground is much broken and can be worked entirely with the pick; it carries considerable clay. J. A. Roeblin Sons, of Trenton, owners.

Cortez Mine (Hydraulic).—See Sailor Boy.

Craycroft Mine (Hydraulic).—This claim is on Alabama Hill, 8 miles by trail from Downieville, at an elevation of nearly 6,000 ft., and controls 11 acres. The channel runs N. and S., with a depth of bank of 25 to 30 ft., and no lava capping. The water season lasts three months, taking water from the Hearst & Haggin ditch, issuing from the east branch of the Middle Fork. A hose with a 2½ in. nozzle is used, with 80 ft. pressure. The sluice tunnel is 300 ft. long, through the rim rock; the flume is 24 in. wide and deep, and paved with rock. The channel

is from 200 to 300 ft. wide; 25 ft. from the bedrock is a layer of big bowlders forming an artificial bedrock, on which the best pay is found. The gold is both coarse and fine, and sells for $18 per ounce. Quicksilver is used in the flume. Twelve men are given work during the season. H. Scamman et al., of Downieville, owners.

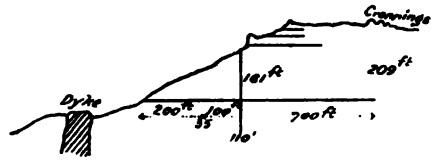
Depot Hill Mine (Placer).—It is 5 miles N. of Camptonville, on the Yuba County line, but the works are in Sierra County. The property comprises about 60 acres. The property was formerly worked as a hydraulic claim, the bank being 125 ft. high and all gravel, except a small soil capping. The gravel is small and contains trunks of petrified trees. The course of the channel is N. 28° E., and it is held to be part of the channel that comes from Brandy City through Grizzly and Indian Hill Diggings, but the evidence in this direction is far from convincing. The bedrock has a very flat grade, on account of which a bedrock tunnel is being run up to the old pit, and has a length of 500 ft.; it is at present well timbered throughout, and of such dimensions as to permit the placing of a 30 in. flume below the track when completed, the posts being 8 ft. high placed on sills 5 ft. apart. The water supply comes from the head of Willow Creek through half a mile of ditch, furnishing part of the year 250 in., and all the year 25 in. There are 5,000 ft. of flume, 30 by 24 in., lined with block riffles and set to a grade of from 2 to 2½ in. to the box. The head boxes are cleaned up as occasion demands, but the main flume is only cleaned up once a year. The gold is over .900 fine and about the size of wheat grains. Forty acres of the ground have been worked during the past twenty-seven years; 20 acres still remain. The work is confined to driving the tunnel ahead and cleaning up the bedrock; the latter being slate, slacks down several inches when exposed to atmospheric influences, and can be repeatedly washed off. Small quartz stringers traverse the slate all over, and no doubt, as they carry sulphurets, help to enrich the bedrock. F. Joubert et al., of Camptonville, owners.

Docile Mine (Quartz).—This is on the South Fork of Kanaka Creek, 2 miles N.E. from Alleghany, and contains 1,200 by 400 ft. on a N. and S. vein, dipping to the E., in serpentine, with partial slate casings. The vein carries considerable mariposite. The walls are about 4 ft. apart, inclosing from 8 to 18 in. of quartz. The pay shoots are short, carrying a large percentage of arsenical pyrites rich in gold. The development consists of two tunnels, each cross-cutting the vein at a distance of about 450 ft., and then following the vein. The lower tunnel has a length of 1,000 ft. In and below the upper tunnel a short pay shoot developed quite a swell of very rich quartz, but on working down on it the foul air stopped operations. The mine is being worked on a lease. Docile Gold Mining Company, owners; F. Smith, of San Francisco, President; J. Freeborough, of Alleghany, lessee.

Dreadnaught Mine (Quartz).—This is in Dreadnaught Ravine, 2 miles E. of Alleghany; it comprises 1,500 by 600 ft. on a N. and S. vein, dipping 72° W., and has a width of 2½ ft., between slate walls. The developments consist of two tunnels, about 40 ft. apart; the lower one is about 500 ft. long; the upper one, which reaches farther on the vein, shows a good-sized vein in the breast, while below it is pinched to a small seam. The quartz carries some sulphurets. A small Kendall 1-stamp mill, run in summer by the water in the ravine, does the crushing. S. S. Crafts & Son, of Alleghany, owners.

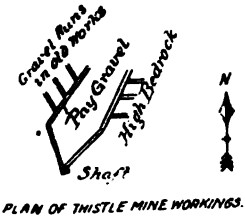
Empire Mine (Quartz).—This property is in Secs. 25 and 26, T. 21 N., R. 11 E., in Gold Valley, 13 miles E. of Downieville, and is reached by pack trail. The vein courses N. 65° E. and dips 50° S.E.; the walls are partly slate and partly diabase. A heavy dike, striking E. and W., cuts the vein and throws it to the west. The pay shoot, 8 ft. wide, commences near the surface on the south side of the crossing, and pitches to the south, carrying about 6 per cent of sulphurets. Numerous quartz seams make off on the hanging-wall side, and have been followed in some instances.

The developments consist of a main tunnel on the vein 700 ft. long and 209 ft. below the outcrop. At 200 ft. from its mouth a shaft (No. 1) has been sunk 35 ft., and 100 ft. beyond this is a shaft (No. 2) 52 ft. deep, which has been continued upward 161 ft. to the surface. Above the collar of the air shaft is an upper tunnel 200 ft. in length. In the bottom of shaft No. 2, below the main tunnel, is a fine vein 5 ft. wide. The ore is hoisted by windlass, and the arrangements for ventilation are very inadequate. Large sums of money have been expended for the reduction of the ores; furnaces and a chlorination plant, besides a mill (Tustin pulverizer) and a cyanide plant, having been tried at different times, but without effective results. It is the intention to replace all these with a stamp mill. A great hindrance to the working of the mine is the high altitude, over 7,000 ft., with the long winters (six months) and deep snows. G. D. Gray et al., of San Francisco, owners.



SECTION OF EMPIRE MINE, SIERRA CO.

Excelsior Mine (Drift).—It is 1½ miles S.E. of St. Louis, and comprises 48 acres. A bedrock tunnel, in hard blue slate, extends 1,400 ft. back into the ridge, but will have to be continued at least 1,500 ft. to tap the Howland Flat and Port Wine channels; a 30 ft. upraise from the tunnel cut into an overflow of gravel 200 ft. wide. The gangways are over 400 ft. long, and come out to the surface on the face of the bank. The main gangway runs S. 42° E. up the middle of the claim; the drifts, run N.E. and S.W., are carried from 3½ to 4½ ft. high. The breasts, 100 ft. wide, are timbered with square sets and lagged. Four to five carloads, weighing a ton each, are breasted out per man. The gravel yields both coarse and fine gold, worth $19 50 per ounce. The water from the mine is gathered in an old cut, 120 ft. long by 20 ft. deep, and is used for washing once a day. The line of sluices is 60 ft. long and 14 in. wide; quicksilver is used in the last three boxes, and they are cleaned up after each washing. The lava and pipe-clay capping is from 200 to 300 ft., and the gravel 70 ft. deep. Excelsior Drift Mining Company, owners; W. N. Bissett, of St. Louis, Superintendent.



PLAN OF THISTLE MINE WORKINGS.

Feather Fork (*Thistle Shaft*) *Gold Gravel Company* (Drift).—The property has been described in our XIth Report, pp. 330 and 419, and is situated on the Gibsonville Ridge, 2 miles S. W. from Gibsonville. The shaft is 450 ft. deep. Operations in the former workings have been suspended, and a new station started 20 ft. above,

and a main gangway run diagonally to the channel, thence 500 ft. N. From this gangway five 60 ft. "runs" start. The present output is 3,000 carloads of 1 ton each, which will be increased in the spring to 8,000 carloads. Seventy men are employed. Feather Fork Gold Gravel Company, of Gibsonville, owners.

Fessler Mine (Quartz).—See Bullion.

Garibaldi Mine (Quartz).—See our XIth Report, p. 405.

Gibsonville Water and Nevada Mining Company (Hydraulic).—This is three fourths of a mile N.E. of Gibsonville, on the north branch of Slate Creek. The work was done on what was supposed to be the front channel of the Gibsonville Ridge. The bank is from 8 to 9 ft. deep, and carries quartz gravel. G. W. Cox, of Table Rock, agent.

Glidden (Gold Lake) Mine (Quartz).—This is in Gold Valley, 1½ miles N.E. from the Empire Mine, in T. 21 N., R. 11 E., and is closed down through litigation.

Gold Bluff Mine (Quartz).—This property was described in our VIIIth Report, p. 579, and is 1½ miles N.E. of Downieville. It recently changed hands, and the new owners have reconstructed the entire plant. The mill of 20-stamps has been placed on the level of tunnel No. 4, and on account of the lack of space between it and the river, the ore, after passing through the Blake crusher, is hoisted by an elevator to the ore-bin, which has a capacity of 500 tons. The 20 stamps weigh 850 lbs. each, and drop 5 in. 80 times a minute, in the following order: 5, 1, 4, 2, 3, with a 6 in. discharge, through a No. 7 diagonal slot screen. The cams, tappets, and bosses are steel, as well as the shoes and dies. The plating consists of a short battery plate; a 4 by 4 ft. apron, set on a 1¾ in. grade, leading to a quicksilver trap, followed by 6 ft. of plates set on a 1½ in. grade. Below follow four Johnston concentrators, set at 110 strokes, the belt revolving once in seven minutes. The water that passes over the upper end of the concentrator is passed through five boxes below, entering alternately top and bottom and depositing slime sulphurets in each. The tailings from the concentrates are pumped up and passed over a pointed box (Spitzkasten) and a series of drop boxes, before dropping into the river. The water is applied under 275 ft. pressure, acting on a 5 ft. Dodd wheel for the elevator and the rockbreaker, a 6 ft. Dodd for the mill, and a 3 ft. Dodd for the concentrators. The plates are cleaned up every other day, the battery once a month, and the inside battery plate every day. It is claimed that 86 per cent is saved in the battery and only 14 per cent on the plates; and 80 per cent of this latter comes from the battery apron-plate. The tailings are said to assay only a trace. The sulphurets are dried and stored with the intention of erecting a small chlorination plant later. The crushing capacity will likewise be increased as soon as the developments of the mine progress. Gold Bluff Mining Company, owners; W. Kraft, of Downieville, Superintendent.

Golden King Mine (Quartz).—See our XIth Report, p. 417. It is 1½ miles E. of Alleghany, and comprises two claims, 2,400 by 600 ft., situated on both sides of Kanaka Creek. At date of visit, tunnel No. 1 had reached a length of 350 ft.; tunnel No. 2, 550 ft., and tunnel No. 3, on the south of the creek, 235 ft. Between No. 1 and No. 2 a perpendicular double-compartment shaft, 4 by 8 ft. in the clear, timbered and plank-lined, has been put down 114 ft. A steam hoisting works and a 4 in. Dow pump are in course of construction. The mine makes 2 in. of

water. A mill site has been graded and a mill will be erected as soon as the hoisting works are completed. The engine is of 15 horse-power, with an upright boiler. Ventilation is secured by a water-blast in the shaft. Twenty-four men are employed. Golden King Mining Company, owners; L. H. Newton, of Alleghany, Superintendent.

Good Hope Mine (Quartz).—See Oxford Mine.

Hanley & Co.'s Gravel Claim (Drift).—The claim is in French Ravine District, about 3 miles from Alleghany, and comprises 140 acres of patented ground, containing an E. and W. channel, about 400 ft. wide, only 150 ft. of which (that adjoining the south rim) carries pay. The lava capping is 75 ft. deep; the gravel is 50 ft. deep, of the blue character, quartz and slate mixed, carrying 35 per cent of bowlders and cobbles, which, on account of the scarcity of available water, are closely sorted out in the mine.

The gold, scattered throughout the lower part of the gravel, is fine and flaky, selling for $18 75 per ounce. Four tunnels have been run at different levels, but only two were deep enough. The present working tunnel, 6 by 6 ft., has a course N. 25° W. It is run in serpentine the greater distance, but partly in lava and cement. At 1,800 ft. it reaches the channel. The gravel gangway extends up the channel 400 ft., and an estimated length of 4,000 ft. of channel lies beyond. The gravel breasts are carried 40 ft. wide; the drifts are 6 ft. high. In the main tunnel the posts are 6 ft., caps 4 ft. The ventilation in the mine is very imperfect, but this will be remedied as soon as the connection is completed between the two tunnels. From 3 to 4 in. of water issues from the tunnel, and is retained in a reservoir 16 by 20 by 20 ft., for washing. The dump will carry 3,000 carloads; 20 carloads can be washed a day in summer time with 30 ft. pressure through a 2 in. nozzle. The gravel, being cemented, is washed through two strings of sluices with a 25 ft. drop and a bedrock flume between them; the tailings are impounded behind a brush dam, and after two years' slacking are run through a third string of sluices. The sluices are 16 in. wide and 14 in. high, and supplied with cross riffles, blocks, and rocks; the entire length of the sluices is over 600 ft. The head boxes are cleaned up every two weeks, the main sluices every three months. Quicksilver is used in the lower part of the sluices; the gold does not unite with it readily. W. F. Hanley et al., of Alleghany, owners.

Happy Hollow Mine (Drift).—See Union Consolidated.

Hawkeye and Bell Point Consolidated Gravel Mine (Drift).—It is 5 miles N.E. from Minnesota. The channel courses N.E. and S.W. and is 600 ft. wide, between rims, with from 6 to 18 ft. of gravel, which is white quartz; the pay streak extends 175 ft. across. The gravel is breasted 50 ft. wide on both sides of the gangway, and the drifts are carried from 3½ to 4½ ft. high, timbered with single posts and caps. A breaster takes down 5 carloads per shift. The claim has a width of 800 ft., and extends a mile on the course of the channel. The tunnel is run 400 ft. up the channel, partly in bedrock; about 400 ft. in length of the channel has been worked. The dump holds 3,000 loads, and the gravel is washed from a reservoir 18 by 8 ft., through 120 ft. of sluices 14 in. wide; the boxes are cleaned weekly. The gold is fine and worth $18 60 per ounce, and is obtained with the aid of quicksilver. Ventilation is effected through air gangways. Water is brought through 1½ miles of ditch from the head of Little Wolf Creek; the season lasts nine months

in the year. In the spring of the year 10 in. of water issues from the tunnel. Martin Mehan et al., of Minnesota, owners.

Italian Mine (Drift).—This is at the lower end of Indian Valley, and comprises 5 acres, being 1,000 ft. on the face of the bluff and back to the center of the ridge. The face is 150 ft. deep with 50 ft. of lava capping, 30 ft. of large rocks, and finally quartz gravel cemented on the bottom. The principal pay is next the slate bedrock. A drift has been run in 200 ft. and 10 ft. high. There are no big rocks in the gravel. The gold is worth $18 75 per ounce.

Jackson's Claim (Placer).—This is on the S. side of the North Yuba, 9 miles N.W. of Camptonville. The property consists of 1,500 by 600 ft. along the bank of the river, and a tailings claim up One Horse Ravine. The elevation of the North Yuba River at this point is 2,450 ft. The river bar carries about 25 ft. of gravel, which was partly worked in former times with large returns. The gold is shaped like wheat grains. The channel of the former river here has a N.E. and S.W. course, and is about 120 ft. wide; 200 ft. of the channel has been breasted out to a height of 4 ft., and timbered with posts and caps. The water season lasts about sixty days. E. T. Jackson, of Camptonville, owner.

Kanaka Mine (Quartz).—See our XIth Report, p. 404. L. Voss, of Downieville, owner.

Keystone Gold Mine (Quartz).—See our Xth and XIth Reports, pp. 653 and 403.

Lawlor Mine (Quartz).—See Mount Moriah.

Lone Star Consolidated Gold Mining Company (Quartz).—The property was described in our XIth Report, p. 405, and is situated in Gold Valley, in Sec. 25, T. 20 N., R. 11 E., about 13½ miles E. of Downieville, at an altitude of nearly 7,000 ft. The vein courses N.W. A tunnel has been run 600 ft., cross-cutting a large low-grade quartz vein, and continued beyond to the Lone Star vein, on which it is turned north; the depth gained is only 80 ft. The tunnel is being driven ahead by two men on contract. Lone Star Consolidated Gold Mining Company, owners; J. Weissbein, of Grass Valley, Secretary.

Lucky Hill Mine (Drift).—This claim is 1½ miles S.W. from St. Louis and 3 miles from Scales Diggings, on the ridge between Slate Creek and Big Cañon, and it comprises 640 acres. Two small prospect shafts were sunk, one of which reached the rim gravel. At present a bedrock tunnel is being driven in slate bedrock; it is 200 ft. long to date. C. Hendel et al., of La Porte, owners.

Lucky Dog Gravel Mine (Drift).—This is 1½ miles W. of Forest City, and embraces three locations. A prospect drift running north is in 400 ft., most of the way in bedrock, but the last 100 ft. in lava, with some sand beneath; the bedrock is dipping off to the west. J. Smith, of Forest City, Superintendent.

Mammoth Springs Mine (Drift).—This claim is on a ridge between Chip's Flat and the Bald Mountain Extension. At a point facing the creek is an outbreak of gravel, with lava capping, and 40 ft. below this the lower level of the works starts north, but bends around to the west. This tunnel is run 2,000 ft. in bedrock, and upraises of 40 and 60 ft. have been made into barren gravel. About 50 ft. above, farther up the slope of the hill, corresponding to a point 1,200 ft. from the mouth of the tunnel, a second tunnel has been run N.W. about 1,450 ft., mostly in cement, but cutting bedrock 700 ft. from the mouth. From this tun-

nel a shaft 60 ft. deep, near the back end, has been sunk to the gravel below without finding pay. This tunnel is ventilated by a water-blast and air-boxes 8 by 10 in. Mammoth Springs Mining Company, owners; J. Spalding, of Forest City, Superintendent.

Mercer and Salinas Mine (Quartz).—See our Xth and XIth Reports, pp. 649 and 413.

Mining Investment (*Mountain Ledge*) *Company* (Quartz).—The property was described in our Xth Report, p. 647, and is in Sec. 16, T. 20 N., R. 12 E., 3½ miles N.E. from Sierra City, and has been shut down some time through litigation; but 9 men have been put on lately to make an upraise from tunnel No. 3 to the pay shoot above, which pitches to the northwest. Mining Investment Company, owners; G. M. Pinney, of Sierra City, manager.

Mount Fillmore Consolidated Mine (Quartz).—It is situated on the S. side of Mount Fillmore, 6 miles from Gibsonville. This is a new location. The property contains five claims, with only a little prospect work, which shows a porphyry dike with quartz, coursing a little W. of N. and showing a width of 60 ft. on the surface. The ore body carries a large amount of arsenical pyrites, in places over 30 per cent. C. B. Wingate et al., of Gibsonville, owners.

Mount Moriah (*Lawler*) *Mine* (Quartz).—This property is in American Hill District, 7 miles N.E. of Minnesota, on Little Wolf Creek, at an altitude of 5,000 ft. There are three claims on the line of the lode, which courses N. and S. and dips 40° W. The property has recently changed hands, and is being put in a condition to be worked on an extensive scale. A portable sawmill has been erected, and three tunnels commenced at the N. and S. ends of the claim, and one near the center. No. 1 is 208, No. 2, 250, and No. 3, 300 ft. long. A fourth tunnel is to be started near the south end of the claim, which will cut the vein 1,000 ft. deep, and will be used to deliver the ore direct to the mill, which will contain 40 stamps run by water taken from Wolf Creek, and delivered under 600 ft. pressure. The principal vein crops out near the apex of the ridge for a distance of three fourths of a mile; and a second vein crops out in places below. In driving No. 1 tunnel three veins were cut about 30 ft. apart, varying from 2 to 8 ft. in thickness. The walls are argillite, with a good gouge between. The quartz carries iron and arsenical pyrites, said to assay quite high. The finest kind of timber, including plenty of sugar pine, covers the ground. Twelve men were working, but more were to be added. D. R. McIntosh et al., of San Francisco, owners.

Mountain Ledge Mine (Quartz).—See Mining Investment Company.

Oxford Mine (Quartz).—This property is in Secs. 22, 23, 26, 27, T. 20 N., R. 10 E., 1 mile N.E. of Downieville, and comprises 6,500 ft. in length on the vein, and a mill site extending down to the North Fork of the Yuba River. The principal vein of the claim is the Good Hope, which courses N.W. and dips 75° E., and is on the contact of the slate and serpentine, averaging 4 ft. in width; the serpentine forms the west wall. A good clay gouge is on both sides of the vein. The apex of the ledge on the top of the ridge is at an elevation of 4,475 ft.; the pitch of the hill is about 40°, while the main tunnel, starting from the east side of the claim, is at an elevation of 3,400 ft. This tunnel, cross-cutting the slate to the west, reaches the vein at 676 ft., and is continued across it 100 ft. to the serpentine. Prior to reaching the contact, or Good Hope vein,

which is 4 ft. in width, several other strong veins were cut, but not prospected. A drift was turned and run 900 ft. on the Good Hope to the N.W., where a water crossing was cut. From this level to the surface, a distance of 900 ft., no stoping has been done. At an altitude of 3,825 ft. a former tunnel reached the vein and several thousand tons of quartz were extracted; this tunnel was caved at the mouth. No timbering is required in the main tunnel, and ventilation is secured by a water-blast with 11 in. and 5 in. air pipes. Ninety acres of timber land are included in the property, the whole being patented. H. H. Purdy et al., of Downieville, owners.

Phœnix Gold Mine (Quartz).—See our Xth and XIth Reports, pp. 653 and 432.

Pioneer Mine (Drift).—See our Xth Report, p. 412. It is in Sec. 13, T. 21 N., R. 9 E. The works have been greatly extended in the past season. Several tunnels have been driven on the channel, timbered with 7 ft. posts and 4 ft. caps. The breasts are carried 35 ft., and the breasting timbers are from 3½ to 5 ft. high. From the mouth of the tunnel to the incline is a distance of 1,063 ft.; a 12 horse-power gasoline engine is placed here to do the pumping and hoisting. The incline is 140 ft. deep on the slope, equal to 35 ft. perpendicular. From the bottom of the incline to the first breast is 94 ft., and the main gangway is extended 200 ft. There are 35 men employed in the mine. A large portion of this mine would pay to hydraulic, which was the former method of working it. Pioneer Drift Mining Company, owners; C. S. Deitem, of Port Wine, Superintendent.

Plumbago Gold Mining Company (Quartz).—It is half a mile N. of Minnesota, and consists of two claims, 3,000 by 600 ft. The course of the vein is N. 75° E., with a dip 45° N. The foot-wall is serpentine and the hanging-wall slate, with an average of 2 feet of vein matter between them. The ledge carries 2 per cent of sulphurets of high grade, mostly arsenical pyrites. The developments consist of two tunnels, 150 ft. apart perpendicularly. No. 1 is 700 ft. and No. 2 300 ft. long; both run to the ledge, and are connected by upraises. From the upper tunnel to the surface there are 170 ft. of backs. A 5 ft. Huntington mill, to be run by steam, is not in working order. Wood is abundant; with a small outlay water can be brought to the mine from Wolf Creek. Working. C. Hegarty, of Moore's Flat, owner.

Rainbow Mine (Quartz).—This in Chip's Flat, and comprises 4,500 by 600 ft. The vein courses E. and W. and pitches N., between slate and serpentine. The developments consist of a tunnel on the mill level on Kanaka Creek, 2,500 ft. long, cross-cutting to the ledge and passing through a stringer at 2,000 ft.; an upraise connects with an upper tunnel 2,000 ft. long. W. F. Hanley et al., of Alleghany, owners.

Reece Ravine Diggings (Placer).—This is 3 miles S. from Poker Flat, and includes 100 acres, at an elevation of 5,000 ft. above sea-level. The course of the channel is N. and S. on the Gibsonville and Howland Flat channel. It requires the running of a bedrock tunnel. Snow water is used for washing. J. R. Alexander, of Table Rock, owner.

Riffle Mine (Drift).—This is 2 miles S. of St. Louis, in Grass Valley, and comprises 1,000 ft. on the course of the channel. The bedrock tunnel runs 2,000 ft. in slate; 200 ft. back from the breast is an upraise of 12 ft. into gravel 40 ft. thick, carrying gold throughout, though best on the bedrock. About 1,500 ft. from the mouth of the tunnel an air shaft

has been raised 140 ft., all in gravel. The course of the channel is N.E. and S.W. The gangways are timbered with 7 ft. posts, and the breasts are from 25 to 40 ft. wide, filled in 8 ft. back of gangways with bowlders. The gravel is quartz, carrying two distinct qualities of gold; the best sells for $18 50 per ounce. W. Prosser, of Port Wine, Superintendent.

Rising Sun Mine (Quartz).—See our XIth Report, p. 418.

Rocky Peak Mining Company (Drift).—It is at Monterey, 4 miles N.E. of Brandy City, on the Brandy City and Eureka ridge, and comprises 700 acres. It is thought that an old, deep river channel passes along the ridge, which, if correct, would seem to be a continuation of the Port Wine channel. It is to tap this channel that this company are running a bedrock tunnel at an elevation of 4,015 ft. above sea-level. The direction of the tunnel is N. 70° W., and it is started along a reef of hard silicious slates. At 180 ft. from the mouth it branches, running in clay and sands with hard slate rim. At the back of the tunnel "bogus gravel" (barren gravel) makes into the top of the drift. A water-blast with wooden air-boxes, 6 in. by 8 in., is run by the water issuing from the tunnel. There is a lava capping on the ridge of at least 240 ft. Near this tunnel the channel is thought to cross through the ridge from the Bunker Hill side of the ridge to the North Yuba side. The tunnel is timbered with 3 ft. 4 in. caps in the clear and 6 ft. posts, with 6 ft. spread. Rocky Peak Mining Company, owners; J. Arnott, of Camptonville, Superintendent.

Ruby Gravel Mining Company (Drift).—This property was mentioned in our XIth Report, p. 406. It comprises 440 acres, situated on Rock Creek, into which the tailings dump. As there are three separate channels, with a difference of over 100 ft. in their elevation, the working conditions in the mine are somewhat complex. They all have a general N. and S. course; the center, or lava channel, cuts down through the White Quartz or Bald Mountain channel from the east side, crossing again lower down from the west side. The lowest channel is blue gravel, and is known as the Deep Rock Creek channel, supposed to be a continuation of the one found in Raps Ravine, that passes through the Young American claim near Forest City. The matter of ventilation has received considerable attention. A water-blast, with 50 ft. fall, drives the air into a section of the main tunnel, 8 by 8 ft., which is closely boxed up, and from which an iron pipe 22 in. in diameter extends along the tunnel leading to an air pipe 24 in. square, diminishing to a 13 in. pipe. About 2,200 ft. from the mouth the tunnel forks; also the air pipe. One branch furnishes ventilation to the northern section of the works, the other to the southern. Up to the fork the tunnel was driven with Burleigh drills, at a cost of $50,000. The timbers in the tunnel consist of 6½ ft. posts, 4 ft. 8 in. caps in the clear, with a 10 ft. spread, each set costing $1 50. The breasts are timbered with single posts and caps and lagged at the top. The present output is about 50 carloads, of 1 ton weight each, or 5 carloads per shift to the breaster.

A quartz vein has been cut in the tunnel with a N.E. and a S.W. course and dipping W., and has been drifted on both ways; on the south drift a shaft was sunk 30 ft. The quartz, except on the pay shoot, which pitches to the north, has a dry, barren appearance; along the pay shoot it carries free gold and a considerable percentage of iron sulphurets. This point in the mine is 500 ft. below the surface. At

present there are only 27 men at work. Ruby Gold Gravel Mining Company, owners; E. McCormack, of Forest City, Superintendent.

Russell Hill Claim (Drift).—This is on Depot Hill, adjoining the Joubert Mine, 5 miles N. from Camptonville, and comprises fifteen 100 ft. square claims. As the property is apparently the same as the rest of Depot Hill deposits, a 125 ft. bank is found with about 20 ft. of pipe-clay on top, and a very small grade to the bedrock; but unlike the other claims, the bedrock is hard and seamy, traversed by a dike, and the gravel, especially near the bedrock, is cemented. The gold near the center of the channel is fine, while along the "vein" it is coarse. The channel is about 150 ft. wide. A drift has been run on the bedrock 200 ft., and 30 ft. breasts opened, carried 6 ft. high. The gold sells for $18 per ounce. The gravel is washed through 200 ft. of boxes lined with block riffles; quicksilver is used in the flume. Water is obtained from tributaries of Indian Creek through 2½ miles of ditch, the water season lasting about three and one half months. W. S. Russell et al., of Camptonville, owners.

Sailor Boy Diggings (Hydraulic).—These are situated on the Brandy City channel close to Brandy City, and contain 1,000 ft. up and down the ridge. The channel is about 300 ft. wide, and its course here is N. 32°. The bank is 75 ft. high, with 30 ft. of capping. The gravel carries gold throughout, although richest near the bedrock, from 4 to 6 ft.; it is scaly and sells for $19 per ounce. The gravel also carries platinum. The elevation of the bedrock is 3,475 ft. On the bedrock there are extremely large bowlders. The water season is about ninety days. The water comes from Cherokee Creek, and is delivered to one "giant" with a 5 in. nozzle, through 300 ft. of 11 in. pipe, under 75 ft. pressure. There are 2,200 ft. of flume in all, 4 by 3 ft., in cross-sections, and paved with rocks, and on a 6 in. grade. The tailings dump into Boise Ravine. The flumes are cleaned up at the end of season. The banks are loosened up in short drifts by the use of giant powder; in places on the bedrock a very hard cement is found. M. Carter, of Camptonville, lessee.

Scotia and Alice Consolidated Mine (Quartz).—This is 3 miles S. of Forest City, in French Ravine, and consists of two claims, 300 by 600 ft., joining at an angle. The Scotia is an E. and W. vein, and dips N.; the Alice dips W.; both lie flat in serpentine and have an average width of 1 ft. The quartz shows free gold and carries copper sulphurets. Developments on the Scotia comprise a 75 ft. incline shaft on the vein, and a tunnel 110 ft. long, reaching 8 ft. below the bottom of the shaft. The tunnel is to be continued to the Alice vein. W. H. Smith, of Alleghany, owner.

Sierra Buttes Mine (Quartz).—The property has been described in our VIth (Part II), VIIIth, Xth, and XIth Reports, pp. 56, 573, 642, and 402. At present the workings of the mine are confined to the upper levels with a small crew of men. Sierra Buttes Mining Company, owners; S. Thomas, of Sierra City, Superintendent.

Snowden Gravel Mine (Drift).—This is in Chip's Flat. A new tunnel is being run to tap a channel 80 ft. wide, lying east of the Blue Lead, but at a higher elevation. The gravel is quartz; bedrock slate. O. Owens et al., of Alleghany, owners.

South Fork Gold Mine (Drift).—This claim is in Forest City. A long tunnel has been driven on the S.E. side of the town, parallel with the creek, to cut a channel running N.W., but was diverted from its course

to the east and the channel missed. Later the company worked their property through the tunnel of the Old Bald Mountain Extension, which is situated N.E. of town at the foot of Bald Mountain. The channel has been worked 600 ft. wide. The gold is coarse and is worth $19 per ounce. Each man breasts out 5 carloads on a shift. W. A. Morse et al., of Downieville, owners.

Suffolk Gold Mine (Drift).—This is on the Howland Flat and Port Wine channel; the claim consists of 1,800 ft. along the channel. The course of the channel is north and its width 600 ft. The tunnel runs W. 700 ft., then N. 120 ft., then E. 300 ft., and finally N. 1,000 ft. The first 500 ft. is through the rim rock (slate); thence it follows the channel. Pay gravel is 40 ft. deep, and the breasts are carried 35 ft. wide on each side of the gangway. The timbers of the main tunnel consist of 7 ft. posts and 3 ft. 8 in. caps, with 11 ft. spread; in the gangway the posts are 6½ ft. In the breast single posts and caps are used. An air shaft 322 ft. deep passes through sand, pipe-clay, and lava. The mine furnishes wash water; the reservoirs are 12 by 36 by 8 ft. and 16 by 20 by 8 ft. Each man breasts out 4 carloads of gravel on a shift. Washing is performed every three hours, through 400 ft. of the main sluice line, lined with slat rifles, car wheels, and blocks. Head-boxes are cleaned up every three days. The tailings are dropped into Cañon Creek. Forty men are employed. Feather Fork Gold Gravel Mining Company, owners; D. Moore, of Port Wine, Superintendent.

Sunset Claim (Drift).—This is about one fourth of a mile below Goodyear's Bar, on North Fork of Yuba River. An incline is sunk on the south bank 25 ft. deep, and a tunnel run under the bar 300 ft. to the east, partly in bedrock. The breasts are carried 6 ft. high; the pay is found on the bedrock. Thirty inches of water are handled with a Chinese pump run by an 8 ft. overshot wheel, 2½ ft. breast, supplied with water from Goodyear's Creek by piping across the river. J. R. Williams et al., of Goodyear's Bar, owners.

Taber Gold Mine (Drift).—It is one fourth of a mile S. of Gibsonville, and contains 5,800 ft. on the back line and 1,600 ft. on the front of the Gibsonville ridge. A bedrock tunnel coursing N.W. on a ½ in. grade to the rod has been driven from the Slate Creek side 1,300 ft. in lava and 1,150 ft. in a hard silicious slate; the channel is supposed to be 100 ft. beyond. An air shaft 400 ft. deep strikes the tunnel 2,100 ft. from the mouth, showing 170 ft. of bedrock, 30 ft. of barren gravel, 150 ft. of pipe-clay, 9 ft. of blue gravel, and from there to the surface lava. Altitude at tunnel mouth (read by aneroid), 5,560 ft. The dimensions of the tunnel timbers are 6½ ft. posts and 3½ ft. caps, with 6 ft. spread. H. Taber, of Gibsonville, owner.

Tecumseh (*Marguerite*) *Mine* (Quartz).—See our XIth Report, p. 403.

Thistle Shaft (Drift).—See Feather Fork Mine.

Tough and Hardy Gold Mine (Placer).—This is 1½ miles E. of Camptonville and 300 yds. from the Yuba County line. The property consists of three claims, 4,500 by 600 ft. In following along the bedrock a quartz ledge has been uncovered and cut through by a bedrock drain; it presents a ledge of about 4 ft. in width, with numerous side stringers making into it. The general course of the vein is N. 70° E., with a dip of about 50° W.; the walls are slate and diorite. Except along a shoot of about 150 ft. the quartz appears barren. In the shoot the quartz carries a good percentage of sulphurets of copper and iron. Only surface

developments have been made, but arrangements to sink on the shoot are contemplated. W. B. Meek et al., of Camptonville, owners.

True Fissure Mine (Quartz).—See our XIth Report, p. 405. G. Reynolds et al., of San Francisco, owners.

Union Consolidated (*Happy Hollow*) *Mine* (Drift).—This is usually designated as the Happy Hollow Mine, and lies 5 miles N.E. from La Porte, and comprises five claims (3,900 ft. in length) along the Port Wine channel. The main working tunnel runs 2,050 ft. in bedrock and 700 ft. up the channel, and is connected with an air shaft 275 ft. deep. Tunnel timbers are 7 ft. posts and 3 ft. 8 in. caps, with 11 ft. spread. The gangways are 80 ft. apart, the gravel breast 35 ft. broad and carried 5½ ft. high, timbered with single posts and caps. The gravel (blue quartz) is 10 ft. deep, with a covering of sand. Breasters average 4 cars of 24 cu. ft. each. The amount of cobbles and bowlders is estimated at one fifth of the whole. Most of the channel has been worked, but a second channel is believed to cross the property. The gravel is washed through 800 ft. of sluices, 16 by 20 in., supplied with cross-riffles, car wheels, and blocks. They wash once a day with the water stored in a reservoir 24 by 16 by 12 ft., and clean up twice a week. The gold is fine, and worth $19 25 per ounce. The property is well supplied with spruce and fir timber. At present 10 men are employed in running a branch tunnel. Union Consolidated Drift Mining Company (Limited), owners; G. W. Miller, of Port Wine, Superintendent.

Watts' Placer Mine (Drift).—It is situated between the North Yuba River and Big Humbug Creek, 9 miles N.E. from Camptonville, in Lincoln township, and contains 92 acres of patented land and 30 acres held by possessory title. The channel courses N.W. and S.E., with an average width of 250 ft., and a grade of about 55 ft. to the mile. The bedrock is hard; partly slate, partly granitic. The altitude on the bedrock is 3,500 ft., on the top about 3,900 ft., giving about 400 ft. of gravel with soil capping. The gravel is regular river-wash, with a very large percentage of cobbles and bowlders, which are mostly piled back into the mine in place of timber. The gold is found near to and in the bedrock, and is coarse. The present works consist of a main tunnel running up the channel for 1,100 ft. on the bedrock (1,000 ft. above present river level), with gangways and breasts, on the east side of the tunnel. On the west side of the main tunnel the bedrock seems to pitch off below the tunnel level toward the North Yuba River, and the ground on that side is untouched. The breasts, are carried from 20 to 50 ft. wide and from 3 to 5 ft. high, very little timber being used. The gravel, though free, stands well. Natural ventilation is secured through connection with an old tunnel. The channel has been excavated 700 by 150 ft. This channel is evidently the former river channel at a higher elevation. A large portion of it could be washed by hydraulicking, as Humbug Creek could be made to restrain the debris with little outlay. Each man on a shift breasts out 4 cars, containing 12 cu. ft. each. J. Watts, of Camptonville, owner.

Wide Awake Mine (Drift).—This is situated on Alabama Hill, and comprises 320 acres, supposed to include 1 mile in length on the course of the channel, which is held to be N.W. and S.E. A bedrock tunnel has been run at an elevation of 5,645 ft., N. 70° W., for a distance of 1,400 ft. At 1,000 ft. gravel prospecting 25 cents per ton was struck, when a more westerly course was followed. A branch was carried south

and a short incline sunk into gravel, which was barren. At present a fresh start has been made to the west, now 100 ft. in, with the bedrock in the breast pitching down. A short prospect gravel drift to the north also pitches off fast. The gravel is blue and free. The depth of the gravel, as also the width of the channel, is unknown. The cropping of lava and pipe-clay is about 400 ft. The tunnels are timbered with 7 ft. posts and 3 ft. 8 in. caps, with 9 ft. spread. The breasts are carried 35 ft. wide and 3½ to 4½ ft. high; they are timbered with single posts and caps. About 35 cars of gravel are taken out per day, which can be increased as soon as better ventilation is secured by completing connections now under way. For washing, 300 ft. of boxes are used, besides a bedrock flume; slat riffles, car wheels, Hungarian riffles, and rocks are used to pave the bottoms. The boxes are cleaned every Sunday, the bedrock flume in the spring. Wash water is derived from the tunnel and collected in a reservoir 24 by 24 by 6 ft. The washing is done three times a day and once during the night. The gold is coarse; the largest piece found weighed 8 oz. On account of climate, six months' stores have to be laid in. Joseph Brand, of Downieville, Superintendent.

William Tell Mine (Quartz).—See our Xth Report, p. 653. Caspar Joos et al., of Sierra City, owners.

Young America Mine (Drift).—This claim is at the south end of Forest City. The company owns 250 acres of ground, extending across the ridge down Wet Ravine, a tributary of Kanaka Creek. The channel has a N. and S. course, running across the direction of the present ridge, and has a width of 400 ft. The old works are caved and the present company are driving a tunnel through the slate bedrock from Oregon Gulch; up to date it has attained a length of 450 ft., and will have to be continued 1,200 ft. farther to reach the channel. The ground, which requires no timbering, costs $7 per foot to drive. Late developments on the opposite side of the ridge indicate the presence of a second channel in the company's ground. B. F. Dickinson et al., of Forest City, owners.

Young America Mine (Quartz).—This property was described in our Xth and XIth Reports, pp. 643 and 407, and is doing prospect work at present. Young America Consolidated Quartz Mining Company, owners; T. Brennan, of Sierra City, Superintendent.

SISKIYOU COUNTY.

Siskiyou is one of the most northerly counties of the State. In general resources, attractive to secure development and settlement, it compares very favorably with the other mining counties of the State. Aside from its gold mines, its natural resources include a vast area of available timber lands; mineral-water springs of superior quality; large areas of natural pasturage; fertile, alluvial valleys, suitable for cereal culture and general farming; still other valleys, of greater altitude, making ideal dairy farms, and localities well suited to the culture of the apple and the pear. In addition to these resources, which have been considerably developed, are possibilities in the way of coal, and building and lithographic stone, that are known but undeveloped. Largely mountainous, and surrounded in every direction by mountain barriers, the desirable section of the county is rendered readily accessible from both San Francisco and Portland by the Oregon and California Railroad. The leading industry of the county is gold mining, quartz, and every description of

placer known, and some not known, in the other mining counties of California. If we *except* river mining, which has had its greatest development on the Klamath River, the mining industry in the development of its possibilities is rather behind the rest of California. This is due to its long years of isolation from the rest of the State before the railroad came in, and not to any lack of richness in the lode and placer deposits. Capital has never gone into this section to any extent until recently, and the lack of newcomers has contributed to keep out improvements in methods and machinery.

Dependent on their own labor and natural resources, mining has had rather more than the average of success as compared with better aided localities. There have been fewer great failures and the mines have a general reputation as fair producers. Better means of communication, a better knowledge of gold-bearing deposits, and better methods of workings, have in the last few years been advancing the extent in territory and yield of the mines. In quartz, the Salmon River country is coming to the front with a number of producing mines, one of which, the Gold Run, gives promise of becoming another Black Bear Mine. A new district, Hungry Creek, close to the Oregon line, has been discovered, and many promising quartz ledges prospected, some of which are developing into profitable mines. The richest placer deposits in the county, those of Yreka Basin, mined in early days only on the edges comparatively, are being reopened, with a return of the old yield to reward the judgment and risk of the men who are doing the work. A distinctly new deposit for California, an auriferous conglomerate, has been identified, and its extent traced for several miles. (See special article and map in this volume.) As a whole, the mining industry is on an excellent basis, remunerative to the miners and contributing to the support and development of the other resources of the county.

Ahlgrin's Claim (Hydraulic).—This is 5 miles below Sawyer's Bar, and comprises 40 acres. The bank is from 70 to 80 ft. deep on a former bench of the river. The water is taken from the Little North Fork of North Fork of Salmon River, through 3½ miles of ditch, and delivered to the giant under 175 ft. pressure. A. Ahlgrin, of Sawyer's Bar, owner.

Allgood & Casteel Mine (Placer).—It is on Salmon River, 4½ miles above Somes' Bar. It is worked by pick and shovel in a small way, as water is scarce. The gravel is 14 ft. deep.

Allen Mine (Quartz).—It is in Quartz Valley District. E. Allen, of Oro Fino, owner.

American Bar Mine (Placer).—This mine is on the south bank of the Klamath River, not far from the mouth of Shasta River. American Bar Mining Company, owners; J. C. Bayer, of Hornbrook, Superintendent.

Ampback (*Portuguese, Fagundez*) *Mine.*—See our XIth Report, p. 432.

Andrews & Kettlewood Mine (Hydraulic).—This is near Hamburg Bar, half a mile from the South Fork of Klamath River. M. Andrews and W. Kettlewood, of Hamburg Bar, owners.

Andrews Mine (Placer).—This is half a mile below the mouth of Scott River, on the north side of Klamath River. From 30 to 40 men are employed at this mine. M. Andrews and J. T. Miner, of Scott River, owners.

Andrews & Miner No. 2 Mine (Placer).—This is about half a mile above Hamburg Bar, in the bed of Klamath River. Messrs. Andrews & Miner, of Hamburg Bar, owners.

Auberry Mine (Hydraulic).—This claim is at Cottage Grove, on the north side of Klamath River. R. Auberry, of Cottage Grove, owner.

Ayles & Dunn Mine (Placer).—This is on the South Fork of Salmon River, about 7 miles above the "Forks." Geo. E. Fauch et al., of Black Bear, owners.

Babcock (Santa Ana) Mine (Drift).—This mine is in Cottonwood District. There are several shafts and tunnels, one of which is 300 ft. in length. H. C. Babcock, of Henley, owner.

Bailey Mine (Drift).—It is 6 miles below Seiad, on the north side of Klamath River. M. Bailey, of Seiad, owner.

Baker Mine (Hydraulic).—It is on Indian Creek. Geo. Baker & Sons, of Fort Jones, owners.

Banner Mine (Quartz).—This is in Quartz Valley District. The developments consist of several hundred feet of tunneling. The vein varies from 1 to 4 ft. in width. H. J. Diggles, of Fort Jones, owner.

Barnes Mine (Quartz).—It is in Cherry Creek District. There are three tunnels about 100 ft. in length. Barnes & Co., of Yreka, owners.

Barry & Co.'s Claim (Placer).—This is 2 miles from Sawyer's Bar, and comprises 20 acres. It is a low river bar, and has to be worked with derricks. The face of the gravel bank is 14 ft. deep; the pay exclusively in the 6 to 7 ft. next to the bottom. Water is taken from the river. Barry & James, of Sawyer's Bar, owners.

Beebee Bar Mine (Placer).—It is on the south side of Klamath River, opposite Lime Gulch. J. Cleland, of Yreka, owner.

Beebee Bar Mine (Placer).—This mine is on Scott River, about 2½ miles from Klamath. Chinese Company, owners.

Bender Mine (Quartz).—This is on French Creek, a tributary of Scott River. It is stated that the developments consist of a 200 ft. tunnel and other workings, and that the vein shows an average width of 3 ft. F. C. Bender, of Callahan's Ranch, owner.

Bennett Mine (Drift).—It is at Scott's Bar. W. Bennett, of Scott River, owner.

Bennett Mine (Placer).—This mine is on the west side of Salmon River, about 1 mile below the "Forks." R. H. Bennett, of Forks of Salmon, owner.

Berton & Litcham Mine (Placer).—This is about 4 miles below Oak Bar, on the north side of Klamath River. Berton & Litcham, of Oak Bar, owners.

Big Ben Mine (Hydraulic).—This mine is in Quartz Valley. Portland Company, owners; S. E. Adams, of Fort Jones, Superintendent.

Big China Mine (Placer).—It is on the south side of Klamath River, opposite Empire Bar. Chinese Company, owners.

Big He Mine (Quartz).—This claim is on Empire Creek. There is a 180 ft. tunnel. The vein is said to average 4 ft. in width. Sunset Company, owners; Herman Adams, of Henley, Superintendent.

Big Ledge Mine (Quartz).—This property is in Quartz Valley District. The developments consist of a 30 ft. incline and a 100 ft. tunnel. The vein varies from 18 in. to 4 ft. H. J. Diggles, of Fort Jones, owner.

Black Bear Mine (Quartz).—This is 7 miles south from Sawyer's Bar, and contains six claims. The company employs 45 men. The course of the veins is N.E. and S.W., dip about 35° E., varying in width from 12 in. to 3 ft.; the walls are serpentine and slate. See our VIIIth and

Xth Reports, pp. 620 and 656. Hon. John Daggett, of San Francisco, owner; E. J. Murray, of Black Bear, Superintendent.

Black Jack Mine (Drift).—This is about 1½ miles W. of Hornbrook. The developments consist of several hundred feet of tunneling; the bed, of cemented blue gravel, is about 20 ft. in thickness, and is worked in a custom stamp-mill. W. H. Ritchie, of Henley, Superintendent.

Blind Lode Mine (Quartz).—This is in Oro Fino District. There are several tunnels, varying from 100 to 600 ft. in length; the vein is said to vary from 6 in. to 12 ft. in width. H. J. Diggles, of Fort Jones, owner.

Bloomer Mine (Hydraulic).—This is on the west side of Salmon River, about 5 miles below the Forks of Salmon. W. P. Bennett, of Forks of Salmon, owner.

Blue Bird Mine (Quartz).—It is on Empire Creek. It has a 30 ft. shaft and other workings. J. Randals and B. Griffith, of Hornbrook, owners.

Boles Mine (Placer).—This mine is about 4 miles above the mouth of Horse Creek. W. Robertson, of Scott River, owner.

Bonanza Mine (Quartz).—It is in Grizzly, a tributary of Indian Creek. The developments consist of three tunnels, each of which is about 300 ft. in length. There is a 5-stamp mill at this mine. H. J. Diggles et al., of Fort Jones, owner.

Bowersox Mine (Hydraulic).—It is one fourth of a mile above Somes' Bar, on Salmon River. The water is taken from Somes' Bar Creek by a ditch 1 mile long, 3 ft. wide by 2 ft. deep, on a grade of 2 in. per 12 ft. There are 1,000 ft. of 11 in. pipe, one No. 2 giant with 4 in. nozzle, under 225 ft. head. The creek does not furnish enough water, and a reservoir is now under construction to help out the supply. The bank is 12 ft. high and all gravel. The sluices are 125 ft. long and 20 in. wide; the grade is 11 in. per box, using block riffles. W. H. Bowersox, of Somes' Bar, owner.

Boye (A B C) Mine (Hydraulic and Drift).—This is 4 miles S. from Callahans, and comprises 40 acres on Forks Creek. The hydraulic bank carries 25 ft. of gravel. The drift mine is in the river-bed, with about 300 ft. of tunnel and from 12 to 14 ft. breasts, 6 ft. high. On the bedrock are very heavy granite bowlders; the bedrock is serpentine and carries coarse, black gold, which is worth $18 50 per ounce. C. F. Boye, of Callahans, owner.

Boyle Mine (Quartz).—This is 7 miles W. of Yreka, in Humbug District. The developments consist of numerous tunnels, some of which are several hundred feet in length. The vein is said to vary in width from a few inches to 3 ft. From 25 to 40 men are employed. The ore is worked in a 10-stamp and also in a roller mill. Haggin & Tevis, of New York, owners; — Boyle, of Yreka, Superintendent.

Bozza Mine (Hydraulic).—This is 9½ miles below Happy Camp, on the south side of Klamath River. J. Bozza, of Happy Camp, owner.

Brass Wire Mine (Hydraulic).—It is at Henley. W. H. Smith, of Henley, and A. Harvey, of Yreka, owners.

Bret, Lacy & Barton Mine (Placer).—This mine is about 3 miles above the mouth of Horse Creek. Bret, Lacy & Barton, of Oak Bar, owners.

Brick House Mine (Placer).—This is on the Forks of Hungry Creek. M. Romaine, of Coles, owner.

Brown & Billhaps Mine (Quartz).—It is 4 miles from the mouth of McKenny Creek. They have a 100 ft. tunnel. The vein is 2 ft. wide. Geo. Brown and R. Billhaps, of Walker, owners.

Brown Bear (Everleth) Mine (Quartz).—This is 6 miles S.E. from Sawyer's Bar, and comprises three claims. The vein courses N.E. and S.W. and dips about 45° N., between slate and porphyry walls, from 2 to 12 ft. apart. The developments consist of 400 ft. of tunnel, 150 ft. being a cross-cut to the vein. An upraise is being made to the surface for ventilation. The quartz carries a good percentage of iron sulphurets. A 4-stamp mill, run by water power, crushes the ore at the rate of 1¼ tons per stamp per day, using No. 9 slot screens. The plates are only scraped once per month; 65 per cent of the amalgam is saved in the battery, which has two inside plates. The gold is .869 fine. F. Golden and T. Everleth, of Sawyer's Bar, owners.

Brown, George, Mine (Placer).—It is on the East Fork of Salmon River. George Brown, of Cecilville, owner.

Brunt, Schorb & Co.'s Mine (Drift).—This is on Scott River, about three fourths of a mile below Scott's Bar. The developments consist of more than 1,000 feet of tunneling. Brunt, Schorb et al., of Scott's Bar, owners.

Buckeye Bar Mine (Placer).—This mine is about 12 miles below Empire Bar, on the south side of Klamath River. Chinese Company, owners.

Bumble Bee Mine (Quartz).—This is on Bumble Bee Creek, a tributary of Hungry Creek. There are two 60 ft. tunnels and a 60 ft winze; the vein is 2 to 4 ft. in width. T. Jones and Roberts Estate, of Henley, owners.

Bunker Hill Mine (Hydraulic).—It is 13 miles below Happy Camp, on the south side of Klamath River. George Temple, of Happy Camp, owner.

Burns' Mine (Hydraulic).—This is in Eddy's Gulch, and 3 miles from Sawyer's Bar. W. Burns, of Sawyer's Bar, owner.

California Queen Mine (Quartz).—It is in Cottonwood District. H. Hazlit & Co., of Henley, owners.

Campbell Mines (Hydraulic).—These are situated in Quartz Valley District, and comprise a group of locations at the western base of a mountain range which separates the Oro Fino from Quartz Valley. The mines are worked by hydraulic elevators, and about 30 men are employed. The R. H. Campbell Gold Mining Company, of London, Eng., owners; Chas. Roberts, of Etna, resident agent.

Cannon Mine (Quartz).—This mine is on the South Fork of the Salmon River, about 6 miles above the Forks of the Salmon. The developments consist of a 60 ft. tunnel and other workings; the vein is about 6 in. wide. J. Cannon, of Black Bear, owner.

Carl & Shaw Mine (Quartz).—This is in White's Gulch, about 5 miles from Sawyer's Bar. Carl, Shaw et al., of Sawyer's Bar, owners.

Cavin Mine (Placer).—It is on the South Fork of Hungry Creek. A. Cavin, of Coles, owner.

Centennial Mine (Placer).—This is at the mouth of Dutch Creek, on the north side of the Klamath River. N. G. Gott et al., of Gottville, owners.

Chapman's China Claim (Hydraulic).—This is 3 miles from Callahans, and comprises 20 acres of patented land. The claim is on the

river, with a gravel bank from 50 to 75 ft. high. One "giant," with 2 in. nozzle and a string of 14 in. pipes, is used. The gold is cucumber-seed shaped, and partly black. Chinese Company, owners.

Chronan Mine (Placer).—It is on the North Fork of Salmon River, about 5 miles below Sawyer's Bar. Chronan Bros., of Sawyer's Bar, owners.

Clarey Mine (Placer).—This claim is in the Cottonwood District. S. Clarey, of Henley, owner.

Cleland Mine (Quartz).—It is about 3 miles above the mouth of McKenny Creek. The developments consist of several tunnels about 100 ft. in length, and a 60 ft. shaft. The vein varies from a few inches to 2 ft. in width. F. Cleland, of Yreka, owner.

Clemper Mine (Placer).—This property is on Humbug Creek, 2 miles above the mouth of the Little Humbug. — Clemper, of Walker, owner.

Cole & Barton Mines (Drift and Placer).—These claims are at Oak Bar, on the north side of Klamath River. H. Barton, of Oak Bar, owner.

Columbia (Baldy) Mine (Quartz).—It is 6 miles E. from Scott's Bar. The vein courses E. of N., dips about 35° W., and is 2 ft. wide, between porphyry walls. A 10-stamp mill, run by water power, belongs to the property. R. Denemier, of San Francisco, owner.

Conzetti Mine (Placer and Hydraulic).—This mine is on the South Fork of Salmon River, about 7 miles from Summerville. S. Conzetti, of Cecilville, owner.

Coon Mine (Hydraulic).—This is 8 miles below Happy Camp, on the north side of Klamath River. Chinese Company, owners.

Cory Mine (Quartz).—It is on French Creek, a tributary of Scott River. The developments consist of a 300 ft. tunnel; the vein is about 2 ft. wide. L. H. Cory, of Callahans, owner.

Crapo Mine No. 1 (Hydraulic).—This property is on both sides of Salmon River, and about 4 miles below the Forks of the Salmon. Chinese Company, owners.

Crapo Mine No. 2 (Hydraulic).—It is on the west side of Salmon River, about 600 ft. above the river, and adjoins No. 1. Bennett & McLaughlin, of Forks of Salmon, owners.

Crawford Mine (Drift).—This mine is at Scott's Bar. Crawford & Co., of Scott's Bar, owners.

Crocker Mine (Quartz).—This is in Deadwood District. There are several hundred feet of tunnels. R. E. Crocker et al., of Fort Jones, owners.

Crooker (Williams' Ferry) Mine (Placer).—This mine is on an island in the Klamath, about 3½ miles above American Bar. Crooker Bros., of Henley, owners.

Cummings Mine (Quartz).—It is on Boulder Creek, 3½ miles S. of Callahans, and is 1,500 by 600 ft. The vein courses N. of E. and dips 60° S., with a width of 2½ ft., between a granite hanging-wall and a serpentine foot-wall. The quartz carries considerable iron sulphurets. J. K. Cummings, of Callahans, owner.

Davis Mine (Quartz).—This mine is in Deadwood District, and has a 200 ft. tunnel. L. J. Davis, of Fort Jones, owner.

Del Norte Mine (Hydraulic).—This claim is 1½ miles above Happy Camp, on the south side of Klamath River. Richardson & Camp, of Fort Jones, owners.

Demming & Gardner Mine (Hydraulic).—This claim is in Oro Fino District. Demming & Gardner, of Oro Fino, owners.

Dillon's Hill Mine (Hydraulic).—This is 3 miles below Cottage Grove, on the north side of Klamath River. Chinese Company, owners.

Doolittle (Daggett) Mine (Hydraulic).—This claim is 10 miles below Happy Camp, at the mouth of Clear Creek, and on the north side of Klamath River. A. Doolittle, of Happy Camp, owner.

Dougherty Bros.' Claim (Hydraulic).—This is 12 m. W. of Sawyer's Bar, on the North Fork of Salmon River, and comprises 20 acres. The bank is 60 to 70 ft. high. One giant and a derrick run by waterwheel are used. Dougherty Bros., of Sawyer's Bar, owners.

Duncan Mine (Drift).—This mine is about 5 miles above the mouth of Mill Creek. J. Duncan, of Scott River, owner.

Duzel Mine (Placer).—This claim is on Humbug Creek, about 3 miles above the mouth of the Little Humbug. G. A. Duzel, of Walker, owner.

Eastlick Mine (Hydraulic).—This claim is in Oro Fino Mining District. Eastlick Bros., of Oro Fino, owners.

Eastlick & Lewis Mine (Quartz).—This is in Oro Fino District, and has a 150 ft. tunnel. Eastlick & Lewis, of Oro Fino, owners.

Elk Creek Mine (Placer).—It is one mile below Happy Camp, on the south side of Klamath River. J. Camp, of Fort Jones, owner.

Elliot Mine (Hydraulic).—This claim is about 25 miles below Happy Camp, on the north side of Klamath River. Elliot Bros., of Cottage Grove, owners.

Empire Mine (Quartz).—This is in Empire Creek, 1 mile from Gottville P. O. The developments consist of two tunnels, 100 and 500 ft. long, and a 100 ft. winze. It is provided with a 5-stamp mill run by water power.

Empire Bar Mine (Placer).—This property is at the mouth of Empire Creek, on the north side of Klamath River. Geo. J. McCann et al., of Gottville, owners.

Erno Mine (Quartz).—This is in Quartz Valley. The developments consist of a 200 ft. tunnel and other workings; the vein is about 1 ft. wide. A. Erno, of Oro Fino, owner.

Evening Star Mine (Quartz).—This is on Eddy's Gulch, 7 miles E. of Sawyer's Bar. The vein courses N. of E., with a northerly dip, between slate and porphyry walls, and is from 2 to 6 ft. wide. It is opened by tunnels, and has a 4-stamp mill. J. Daggett and J. S. Doe, of Sawyer's Bar, owners.

Everill Mine (Drift).—This mine is about 1 mile below Oak Bar, on the north side of Klamath River. R. Everill, of Oak Bar, owner.

Everill Mine (Drift).—This is about 4½ miles below Hamburg Bar, on the south side of Klamath River. F. Everill, of Hamburg Bar, owner.

Excelsior Mine (Hydraulic).—This claim is on the North Fork of Salmon River, about 3½ miles above Sawyer's Bar. A ditch is being built to furnish water for working the mine. F. Corbin et al., of Sawyer's Bar, owners.

Fagundez Mines (Placer).—These claims are on Cherry Creek. They consist of two claims. See our XIth Report, p. 432. A. Fernandez & Co., of Yreka, owners.

Fagundez Mine (Quartz).—This is in Eddy's Gulch, about 2½ miles from Sawyer's Bar. The developments consist of several thousand feet

of tunneling, and the vein averages about 10 in. in width. At this mine there is a 5-stamp mill, which is run by water power. R. Fagundez, of Etna, owner.

Fairy Queen Mine (Quartz).—It is on the divide between Empire and Hungry creeks, and is opened by a 160 ft. tunnel. E. McGee, T. Jones et al., of Henley, owners.

Filley & Woods Mine (Placer).—This is about 15 miles above the mouth of Thompson Creek. E. Filley and W. Woods, of Seiad, owners.

Finley Mine (Hydraulic).—This mine is on the North Fork of Salmon River, about 1 mile from Sawyer's Bar. A ditch is being constructed to furnish water for working the mine. S. M. Finley & Sons, of Sawyer's Bar, owners.

Foley's Mine (Hydraulic).—This is 4 miles E. from Callahans, and comprises 20 acres. The bank is 50 ft. high. Water is conveyed through a pipe to a "giant," with a 4 in. nozzle, under 300 ft. head. The tailings pass through 600 ft. of 2 ft. flume, paved with block riffles. The mine is just being opened. Hayes et al., of San Francisco, owners: — Spencer, of Callahans, Superintendent.

Fort Byers Mine (Hydraulic).—This claim is on the north side of Salmon River, about 2½ miles from the "Forks." A ditch is being constructed to furnish water for working the mine. W. P. Bennett and E. McLaughlin, of Forks of Salmon, owners.

Fort Gough Mine (Hydraulic).—This claim is about 5½ miles below Seiad P. O., on the north bank of Klamath River. James Camp, of Fort Jones, owner.

Fortune Mine (Drift).—The mine is at Callahans, on Scott River. A. H. Denny and G. Wiker, of Callahans, owners.

Franks & Moncton Mine (Quartz).—It is in White's Gulch, about 5 miles from Sawyer's Bar. The developments consist of about a 1,000 ft. of shafts and tunneling, and the vein is about 2 ft. wide. The 5-stamp mill at this mine is run by water power. Franks & Moncton, of Sawyer's Bar, owners.

Frisby Mine (Placer).—It is on the South Fork of Hungry Creek. J. Frisby, of Coles, owner.

Gayhart Mine (Placer).—This is about 2½ miles from the mouth of Horse Creek. J. Gayhart, of Oak Bar, owner.

Gee Wah (*Thomas Thomas'*) *Mine* (Drift).—It is on McAdams Creek. Gee Wah Company, of Etna, owners.

Geeshan & Kellner Claim (Hydraulic).—This is 2½ miles below Sawyer's Bar, and comprises 20 acres on a former bench of the river, with a 25 ft. bank of gravel. Geeshan & Kellner, of Sawyer's Bar, owners.

George Mine (Placer and Drift).—This claim is on the South Fork of Salmon River, about 8 miles above Cecilville. W. H. George, of Cecilville, owner.

Gold Ball Mine (Quartz).—This is between the headwaters of Eddy's and White's gulches, 8 miles E. from Sawyer's Bar, and comprises 4,500 by 600 ft. The vein courses N. of E. and dips 45° N., with a width varying from 2 to 8 ft., between slate and porphyry walls. The quartz carries a small percentage of sulphurets. The mine is developed through tunnels, and the ore is crushed in an old style 16-stamp mill. A. Ball et al., of Sawyer's Bar, owners.

Golden Eagle Mine (Quartz).—This mine is on Eagle Creek. There are several hundred feet of tunnels and inclines. There is a 5-stamp mill at the mine. F. D. Fraser, of Fort Jones, owner.

Golden & Everleth Mine (Quartz).—This is 6 miles E. of Sawyer's Bar, and comprises 1,500 by 600 ft. The vein runs N. of E. and dips about 40° N., between slate and porphyry walls. The mine is developed through tunnels, and a 4-stamp mill reduces the ore. Everleth et al., of Sawyer's Bar, owners.

Golden Nugget Mine (Hydraulic).—This is 1 mile N. of Sawyer's Bar, and comprises 136 acres. The bank, all gravel, is 500 ft. high, and is worked by a "giant" with 4 in. nozzle, under at least 100 ft. head. The ground consists of an old river bar and benches, the gravel prospecting throughout. Water is obtained from Eddy's Gulch, and lasts six months. The gold is coarse, cucumber-seed shaped, and sells for $18 per ounce. Thirty boxes are used, set on a 5 in. grade. S. L. Finley, of Sawyer's Bar, owner.

Gold Lead Mine (Hydraulic).—This claim is on Scott River, about 1½ miles below Scott's Bar. H. Andrews, owner.

Gold Note Mine (Placer).—This mine is on the north side of Klamath River, about 2 miles above American Bar.

Gold Run Mine (Quartz).—It is 10 miles from Forks of Salmon, between the forks of Knownothing Creek. See our XIth Report, p. 429. Hansen & Dannenbrinck, of Forks of Salmon, owners.

Gordon Mine (Hydraulic).—This claim is about 7 miles above Happy Camp, on the south side of Klamath River. C. Gordon, of Happy Camp, owner.

Grant Mine (Hydraulic).—This is on the west side of Salmon River, about 12 miles below Forks of Salmon. H. Grant, of Forks of Salmon, owner.

Grattan Mine (Quartz).—This is 12 miles S. from Sawyer's Bar, and comprises 1,500 by 600 ft. The vein courses N. and S. and dips 45° E., between slate and porphyry walls. The only development is a tunnel on the vein. R. H. Campbell and L. Wagner, of Sawyer's Bar, owners.

Greenhorn Blue Gravel Mine (Drift).—This is one fourth of a mile S.W. of Yreka, and comprises 60 acres, 2,904 ft. along the channel, supposed to be the continuation of the Greenhorn Gulch channel, and whose course is N.W. and S.E. The gravel is partly blue, but gray in the upper strata and not cemented; carrying considerable clay and an average amount of cobbles and bowlders. The best pay is contained in the 3 ft. next to bedrock; as also a foot or two in the bedrock. The mine is opened by a single-compartment shaft 110 ft. deep, from which a series of branching gangways lead up to the breasts. On the north side of the breasts a shaft is being raised to the surface, which is to be used as the working shaft when completed. The mine required thorough timbering with 4½ ft. posts, 6 ft. caps, and lagging overhead. The bowlders and cobbles are all thrown back. About 2 ft. of the bedrock is taken up in drifting and breasting. About 350 ft. of the channel has been worked for 120 ft. in width. A small steam engine of about 10 horse-power runs two Knowles pumps and the hoisting works. The dirt is washed at the mouth of the shaft through a short line of sluices, using Hungarian slat riffles. The engine consumes 1 cord of wood per day, costing $3 per cord. Timber is delivered unpeeled at the mine for 4 cents per running foot, and lagging 3 cents apiece. The water is derived from Greenhorn Gulch through the Edson ditch, and also from the mine itself. There is sufficient water for washing purposes throughout the year; in winter there is enough to wash bedrock and rewash tailings.

The gold sells for $17 40 per ounce. A. Lee, of Yreka, owner; A. E. Raynes and T. D. Austin, of Yreka, lessees.

Grider Mine (Hydraulic).—This mine is about 10 miles below Hamburg Bar, on the south side of Klamath River. J. Titus, of San Francisco, owner; W. Grider, of Seiad, Superintendent.

Griffith Mine (Placer).—This mine is on Hungry Creek. J. Griffith, of Henley, owner.

Hanson Diggings (Placer).—This claim is on Salmon River, 4 miles above Somes' Bar. It is said to contain very rich ground, but water is scarce; about 75 in. is collected from Dry Creek, and the gravel is shoveled into the sluices. The mine has lately been sold, and the present owner intends to bring water from Tom Payne Creek by hanging a pipe under a wire cable across the river, which would give him 200 ft. of pressure and water sufficient to supply a giant. The claim contains 20 acres; the gravel is 14 ft. deep. W. H. Bowerson, of Somes' Bar, owner.

Harrigan Mine (Placer).—This is about half a mile above Hamburg Bar, on the south side of Klamath River. M. Harrigan et al., of Hamburg Bar, owners.

Harris Mine (Hydraulic).—This is on the North Fork of Salmon River, and about 5 miles above Sawyer's Bar. A ditch is being constructed to furnish water. Harris Bros., of Etna, owner.

Hart Mine (Placer).—This mine is on Wildcat Creek. C. Hart, of Callahans, owner.

Hayes Mine (Hydraulic).—This property is on Wildcat Creek, a tributary of Scott River. G. H. Hayes, of Callahans, owner.

Heald Mine (Hydraulic).—This claim is situated about 6 miles below Cottage Grove, on the north side of Klamath River. Oakland Company, owners; C. Lord, of Orleans Bar, Superintendent.

Heard & Henry Mine (Placer).—This is in Smith's Gulch Creek, a tributary of the South Fork of Scott River. J. Heard and Jos. Henry, of Callahans, owners.

Hegler Mine (Quartz).—This mine is about 6 miles W. of Yreka. The developments consist of three tunnels, varying from 300 to 400 ft. in length, which are connected by upraises. There are several veins from 10 in. to 2 ft. in thickness. The ore is worked in a 10-stamp mill, run by steam power. Hegler Bros., of Yreka, owners.

Henry Mine (Hydraulic).—This mine is on Beaver Creek. T. Henry, of Coles, owner.

Hibernia Mine (Quartz).—This is on Eddy's Gulch, 2½ miles S.E. from Sawyer's Bar, and comprises 1,500 by 600 feet. The 18 in. vein courses N.E. and dips 40° N., between slate and porphyry walls. The developments consist of a shaft 60 ft. deep and a tunnel run on the vein 200 ft. J. Sallee & Co., of Shasta City, Shasta County, owners; L. Monahan, of Sawyer's Bar, Superintendent.

Hickey Bros.' Claim (Hydraulic).—This is 2½ miles from Sawyer's Bar, and comprises 60 acres. The bench has a 100 ft. bank with 40 ft. of gravel. The water is derived from a neighboring gulch, and the season lasts three months. One "giant" is worked under 200 ft. pressure. Hickey Bros., of Sawyer's Bar, owners.

H. M. Mine (Hydraulic).—This mine is on the South Fork of Scott River. Geo. Murray, of Scott River, owner.

Hoboken Mine (Quartz).—It is on Cherry Creek. The developments consist of three tunnels, 100, 500 and 700 ft. long. H. J. Diggles, of Fort Jones, owner.

Hubbard Mine (Placer).—This claim is on the north side of Klamath River, about 12½ miles below Empire Bar. J. Hubbard, of Oak Bar, owner.

Hull's Gulch Claim (Hydraulic).—See our XIth Report, p. 436. R. H. Campbell Gold Mining Company (Limited), owners.

Humbug Creek Prospect Workings.—On Humbug Creek there are numerous small mines and "prospect" workings, which are worked intermittently.

Hungry Hill (Gold Run) Mine (Quartz).—This mine is on Know-nothing Creek, a tributary of Salmon River. The developments consist of numerous shafts and tunnels; the vein averages about 2 ft. wide. A. Dennenbrienk, of Gilta, owner.

Hunter & Dowey Mine (Quartz).—It is between the North Fork of Salmon River and White's Gulch, and about 5 miles from Sawyer's Bar. H. Hunter and L. Dowey, of Sawyer's Bar, owners.

Indian Girl Mine (Quartz).—This claim is about 9 miles from Hornbrook, on the north bank of Klamath River. The vein is exposed by an open cut 200 ft. long and 10 ft. deep. J. Prince, of Henley, owner.

Ironsides Mine (Quartz).—This is in Cherry Creek District, and is developed by tunnels 80 and 150 ft. long and shafts from 30 to 80 ft. in depth; the vein averages 15 in. wide. James Ironsides et al., of Yreka, owners.

Jackson Mine (Placer).—It is on Little Humbug Creek, about 3 miles from its mouth. B. B. Jackson, of Walker, owner.

Jennie Mine (Quartz).—This is in Riverside District. There are two 60 ft. tunnels. A. Haines and Geo. Hosseck, of Walker, owners.

Jensen, Geo., Mine (Placer).—This mine is about 3 miles above the mouth of McKenny Creek. Geo. Jensen et al., of Oak Bar, owners.

Jerry Lane Mine (Placer).—This property is 10½ miles below Happy Camp, on the north side of Klamath River. Jerry Lane, of Happy Camp, owner.

Jillson Blue Gravel Mine (Hydraulic).—This claim is in Cottonwood District, about 20 miles N. of Yreka. See "Auriferous Conglomerate" in this volume. C. B. Jillson et al., of Henley, owners.

Johnson Mine (Placer).—This mine is 6 miles above the mouth of Horse Creek. — Johnson, of Oak Bar, owner.

Johnson Mine (Quartz).—This is in the Oro Fino District. The developments consist of several hundred feet of tunneling, and the vein shows a thickness of from 4 in. to 3 ft. Johnson Estate, owner; J. Moxley and Chas. Jenner, of Etna, agents.

Jumbo Gold Mine (Quartz).—This is 6 miles from Sawyer's Bar, between the headwaters of Eddy's and White's gulches, and comprises 6,000 by 600 ft. The vein courses N.E. and dips 45° N., between slate and porphyry walls, with a width varying from 3 to 8 ft. The quartz is low grade, with a small percentage of sulphurets. There is a 10-stamp mill on the property. The mine is being developed through tunnels. Dr. A. C. Helm and H. J. Eldridge, of Sawyer's Bar, owners.

Junction Bar Mine (Placer).—This is at the mouth of Scott River. Lang & Co., owners.

Keaton Mine (Placer).—This mine is on Hungry Creek. T. J. Keaton, of Henley, owner.

Kettlewood & Tibbets Mine (Placer).—This claim is about 3½ miles above the mouth of Seiad Creek. W. Kettlewood and F. Tibbets, of Seiad, owners.

Klein's Claim (Hydraulic and Drift).—This is in the vicinity of Sawyer's Bar, and comprises about three fourths of a mile of the river. The bank is 60 ft. in height; the drifting is carried out on a lower bar and extends 150 ft. Water is obtained from Jessup's Gulch, and lasts five months in the year. A derrick and one giant are used. W. E. Klein, of Sawyer's Bar, owner.

Knownothing Mine (Quartz).—This mine is on Knownothing Creek, a tributary of Salmon River. The developments consist of three tunnels, the longest of which is about 1,000 ft. in length. The vein varies in thickness from a few inches to 3 ft. W. P. Bennett and L. Bevan, of Forks of Salmon, owners.

Lain Mine (Hydraulic).—This is 3½ miles below Hamburg Bar, on the south side of Klamath River. Lain Bros., of Hamburg Bar, owners.

Lange Mine (Hydraulic).—This mine is on Barkehouse Creek. Nelson Lange, of Barkehouse, owner.

Lango Mine (Quartz).—This claim is on Barkehouse Creek, about 16 miles W. of Yreka. The developments consist of numerous tunnels and shafts; the vein is about 1 ft. wide. There is a 5-stamp mill run by water power. J. S. Cleland, of Yreka, owner.

Last Chance Mine (Drift).—This is one fourth of a mile north of Callahans, and comprises 20 acres of patented land. The work is carried on in the bed of the river; the gravel is about 50 ft. deep. A shaft had been sunk and 50 ft. drifted on the bedrock, when the water broke in. The gold on the bedrock is coarse. The gravel contains gold throughout, and pays $4 a day to the man. Denny, Flak et al., of Callahans, owners.

Last Chance (Lindsey) Mine (Quartz).—This mine is in Oro Fino District. The developments consist of a 300 ft. tunnel and other workings; the vein is said to be 6 to 18 in. in width. R. S. Lindsey, of Oro Fino, owner.

Lee Mine (Hydraulic).—This claim is at the mouth of Seiad Creek, on the north bank of Klamath River. Chinese Company, owners.

Lee Moy Mine (Placer).—This is on the south side of Klamath River. Lee Moy & Co., of Gottville, owners.

Leonard Mine (Placer).—This consists of two claims situated about 6 miles below Oak Bar, in the bed of the Klamath River. W. Leonard, of Oak Bar, owner.

Liberty Mine (Quartz).—It is in Eddy's Gulch, about 5 miles from Sawyer's Bar. J. S. Hughes et al., of Sawyer's Bar, owners.

Lime Gulch Mine (Placer).—This claim is on the north side of Klamath River, at the mouth of Lime Gulch. Chinese Company, owners.

Little Humbug Mine (Placer).—This is at the mouth of Little Humbug Creek. B. B. Jackson, of Walker, owner.

Live Yankee Mine (Quartz).—See our XIth Report, p. 432.

Low Mine (Placer).—It is on the south side of Klamath River, about 6 miles above American Bar. W. Low, of Henley, owner.

Lowden Mine (Hydraulic).—This claim is about 3 miles below Hamburg Bar, on the south bank of the Klamath River. J. S. Lowden, of Hamburg Bar, owner.

Lowden Bros.' Mine (Placer).—This claim is on Seiad Creek, about 3 miles above its mouth.

Lucky Baldwin Mine (Drift).—This is near Callahans, and is a river claim of 1,500 ft. in length and 450 ft. wide. The gravel bank is about 50 ft. deep. A. H. Bar and P. Holden, of Callahans, owners.

Lucky Bob Mine (Hydraulic).—This mine is at Empire Bar, on the north bank of the Klamath, and about 100 ft. above the river. M. Freshour, of Gottville, owner.

Luke Shaw Mine (Drift).—This property is about 4 miles S. of Hooperville, on Indian Creek. There is said to be a drainage tunnel at this mine which is more than a mile in length. Chinese Company, owners.

Mabel Mine (Quartz).—This is 7 miles E. from Scott's Bar, and comprises one claim. The vein courses E. of N., with a dip of 35° W., between porphyry walls 2 ft. apart. W. A. Chamberlain, of Yreka, owner.

Maloney Mine (Hydraulic).—This mine is on the North Fork of Salmon River, about 3 miles below Sawyer's Bar.

Maplesden Mine (Hydraulic).—This claim is 3½ miles below Hamburg Bar, on the north side of Klamath River. W. Maplesden, of Hamburg Bar, owner.

Maplesden Mine (Drift).—This is at Hamburg Bar, on the south side of Klamath River. Maplesden & Sons, of Hamburg Bar, owners.

Martin Andrews Mine (Drift).—This is at Scott's Bar, on Scott River. W. Bennett, of Scott's Bar, owner.

Mathewson Mine (Quartz).—This is in Cherry Creek District. The developments consist of an 80 ft. and a 150 ft. tunnel, and shafts from 30 to 80 ft. in depth; the vein shows an average width of about 15 in. James Ironsides et al., of Yreka, owners.

McCauley Mine (Drift).—This claim is on Scott River, about 3½ miles above its mouth. The developments consist of a 200 ft. tunnel. James McCauley & Son, of Scott's Bar, owners.

McCoy Mine (Placer).—This mine is on Hungry Creek, and is owned by M. Romaine, of Coles.

McCrey & Maplesden Mine (Hydraulic).—This mine is about one fourth of a mile above Hamburg Bar, on the south side of Klamath River. R. McCrey and B. F. Maplesden, of Hamburg Bar, owners.

McGuffy & Falkenstein Mine (Drift).—This mine is at Scott's Bar. G. McGuffy and Lewis Falkenstein, of Scott's Bar, owners.

McMahon's Claim (Drift).—This is a river claim, one fourth of a mile from Callahans, with 300 ft. front, running back 200 ft. into the ridge. There is a tunnel 750 ft. long, with 12 ft. of a gravel breast; the gravel is 25 ft. high. The bedrock is swelling serpentine. From 8 to 10 tons of gravel, said to be of high grade, are taken out per day. J. W. McMahon, of Callahans, owner.

McNeal Mine (Hydraulic).—This claim is on the east side of Salmon River, and about 4½ miles below Forks of Salmon. George McNeal, of Forks of Salmon, owner.

McNeal's Bar Mine (Hydraulic).—It is at Forks of Salmon, and on the south side of the river. W. P. Bennett, of Forks of Salmon, owner.

Metropolitan Mine (Quartz).—This mine is in White's Gulch, about 4 miles from Sawyer's Bar. It is stated that the developments consist of a 200 ft. tunnel; also that there are two veins in this mine, both of which are about 4 ft. in thickness. A. Parker and others, of Etna, owners.

Midwinter Mine (Quartz).—It is on the south side of Klamath River, about 8 miles from Hornbrook. The developments consist of a 60 ft. tunnel and other workings. There are three other tunnels situated not

far from this, which are owned by the company. W. B. Edmondson & Co., of Henley, owners.

Milich Mine (Hydraulic).—This property is on the east side of Salmon River, about 4½ miles below Forks of Salmon. P. Milich, of Forks of Salmon, owner.

Milligan's Bar Mine (Hydraulic).—This claim is about 17 miles below Happy Camp, on the north side of Klamath River. B. Goodwin, of Happy Camp, owner.

Missouri Bar Mine (Placer).—This mine is on the South Fork of the Salmon River, about 2 miles above the "Forks." W. P. Bennett, of Forks of Salmon, owner.

Montez Mine (Hydraulic).—This is on Salmon River, about 5 miles from its mouth. Clark et al., of Somes' Bar, owners.

Montezuma Mine (Hydraulic).—This is half a mile S. from Callahans, and comprises 40 acres. The claim is a part of a river bed, with a 20 ft. bank of gravel, on the South Fork of Scott River. The gold is both coarse and fine; the former lies near the bedrock. The gold sells for $17 50 per ounce. Twenty-two men work in the claim. Chinese Company, owners.

Montezuma Hill Mine (Hydraulic).—This claim is 14 miles below Happy Camp, on the north side of Klamath River. H. Gasquet, of Del Norte, owner.

Moore & Descher Claim (Drift).—This is 3 miles below Sawyer's Bar, and comprises 20 acres. The property is on a former bench of the river, the bank being 100 ft. high, with 12 ft. of gravel. The developments consist of a 150 ft. tunnel, with 40 ft. of gravel breasts carried 6 ft. high, timbered with post and cap. Twelve carloads of gravel, of 1,500 lbs., are extracted per day. The gold is worth $17 50 per ounce. G. A. Moore and J. Descher, of Sawyer's Bar, owners.

Mountain Belle Mine (Quartz).—It is 1 mile up from the junction of Eliza Fork with North Fork of Humbug Creek. See our XIth Report, p. 444. Cartwright & Phillips, of Yreka, owners.

Mountain Lion and Ohio Mines (Quartz).—These mines are about 5 miles from Hornbrook, on the north side of Klamath River. There are two 50 ft. tunnels and various open cuts. W. A. Jacobs and J. Thompson, of Ashland, Oregon, owners.

Mount Sterling Mine (Placer).—This is on Mount Sterling, and about 18 miles W. of Coles. P. Flett, of Coles, owner.

Muck-a-Muck Mine (Hydraulic).—This claim is about 5 miles above Happy Camp, on the north side of Klamath River. Mrs. M. Reeve, of Happy Camp, owner.

Myers Mine (Placer).—This is about half a mile below Hamburg Bar, and on the south side of Klamath River. W. F. Myers, of Hamburg Bar, owner.

Myers & Smith Claim (Drift).—This is half a mile from Sawyer's Bar, on the north side of Salmon River, and comprises 40 acres of patented land. The ground, which is a high bar, is nearly worked out. Myers & Smith, of Sawyer's Bar, owners.

Nave & Green Mine (Placer).—This mine is on Hungry Creek. J. C. Nave and W. Green, of Henley, owners.

Neft & Sons Mine (Placer).—This claim is about 3½ miles above the mouth of Horse Creek. Neft & Sons, of Oak Bar, owners.

Nelson Mine (Quartz).—See our XIth Report, p. 446.

New York Mine (Quartz).—This is at Hooperville, on Indian Creek. The developments consist of a 600 ft. tunnel and other workings; the vein is from 1 to 8 ft. wide. E. W. Miller, of Fort Jones, owner.

Nicklet Mine (Quartz).—This mine is on Rattlesnake Creek. The developments consist of 500 ft. of tunneling; the vein averages 8 in. in width. C. Nicklet, of Sawyer's Bar, owner.

Nigger Hill Mine (Hydraulic).—This claim is on the South Fork of Salmon River, about 2½ miles above Forks of Salmon. W. P. Bennett, of Forks of Salmon, owner.

Nolan Mine (Placer).—This mine is on the South Fork of Scott River. E. Nolan, of Callahans, owner.

Nolan's Bar Mine (Hydraulic).—This mine is about half a mile below Cottage Grove, on the south side of the Klamath. H. Thomas, of Cottage Grove, owner.

North Star Mine (Quartz).—See Boyle Mine.

Nuggett Bar Mine (Placer).—It is on the South Fork of Salmon River, about 8 miles above Forks of Salmon. Alex. Parker & Son, of Etna, owner.

Oak Grove Mine (Drift).—This is on McAdam Creek. J. A. Lincoln and M. Finley, of Fort Jones, owners.

Ock Mine (Hydraulic).—This claim commences about 2½ miles below Happy Camp, and extends up the northern bank of the river for a distance of about 3 miles. Chinese Company, owners.

Old Buckeye Bar Mine (Placer).—This mine is on McKenny Creek. A. Jackson, of Walker, owner.

Old Fort Jones Mine (Placer).—It is on the north side of Klamath River, about a quarter of a mile below Empire Bar. Chinese Company, owners.

Old Kanaka Mine (Hydraulic).—This claim is on Virginia Bar, on the north side of the Klamath. Geo. Simmons, of Hawkinsville, owner.

Olive Mine (Quartz).—This is at Hooperville, on Indian Creek. The developments consist of two 300 ft. tunnels. J. W. Smith, of Fort Jones, owner.

Olsen Claim (Hydraulic).—This is on the North Fork of Salmon River, 9 miles below Sawyer's Bar, and comprises 20 acres. The bank is 70 to 80 ft. high, carrying 15 ft. of gravel. The water is derived from a neighboring gulch; the season is short. One giant and a 2 ft. flume are used. Fred Olsen, of Sawyer's Bar, owner.

Oregon Bar Mine (Placer).—This mine is on the north bank of Klamath River, about half a mile above the mouth of Shasta River.

Oregonian Mine (Quartz).—This is 3 miles N.E. from Sawyer's Bar, in Rattlesnake Gulch, and comprises four claims. The vein courses E. and W., dips 40° N., and is from 6 to 8 in. wide, between granite walls. Henry H. Hunter, of Sawyer's Bar, owner.

Osceola Mining Company (Quartz).—This is 7 miles E. of Sawyer's Bar, and comprises 3,000 by 600 ft. The vein courses N.E., but has not been struck yet in the tunnel. There is a 5-stamp mill on the property.

Patterson Mine (Hydraulic).—This claim is on Beaver Creek. Patterson Bros., of Coles, owners.

Peters' Mine (Quartz).—This is in White's Gulch, about 6 miles from Sawyer's Bar. Peters Bros., of Sawyer's Bar, owners.

Phillips & Cartwright Mine (Quartz).—This mine is 8 miles W. of Yreka. The developments consist of three tunnels, varying from 200 to

300 ft. in length, and a 300 ft. incline. Phillips & Cartwright, of Yreka, owners.

Phillips Mine (Placer).—This is about 4 miles above the mouth of Seiad Creek. B. Phillips & Son, of Seiad, owners.

Phil Mott Mine (Placer).—This mine is about half a mile below Empire Bar, on the north side of Klamath River. Chinese Company, owners.

Pierson, Jack, Mine (Placer).—This claim is on Little Humbug Creek, about 1 mile above its mouth. J. Pierson, of Walker, owner.

Pierson Mine (Placer).—This is on Humbug Creek. H. White, of Walker, owner.

Pitts Mine (Quartz).—This property is in the Oro Fino District. The developments consist of a 200 ft. tunnel; the vein varies from 2 in. to 1 ft. in width. J. Pitts, of Oro Fino, owner.

Pollard Claim (Drift).—It is a short distance from Callahans, on the South Fork of Scott River, with 900 ft. face and running back into the hill. The working tunnel is between 600 and 700 ft. long; breasts 100 ft. long and 6 ft. high. The channel has the same course as the river, and is 12 ft. wide. Next to the bedrock the gravel is cemented and contains coarse black gold. Jacob Pollard, of Callahans, owner.

Pool Mine (Quartz).—This is on Hungry Creek. There is a 180 ft. tunnel. C. B. Poole et al., of Henley, owners.

Portuguese Bar Mine (Hydraulic).—This mine is about 5 miles below Seiad, on the north bank of the Klamath. Jas. Camp, of Fort Jones, owner.

Preckel Mine (Hydraulic).—This claim is on Sawmill Creek, about one fourth of a mile from Scott's Bar. H. Preckel, of Scott's Bar, owner.

Prince Consort Mine (Quartz).—This is in Cottonwood District. Developments consist of a 180 ft. tunnel. Herman Adams, of Henley, agent.

Providence Mine (Quartz).—This mine is situated in the Oro Fino District. The developments consist of a 300 ft. tunnel; the vein has an average width of 16 in. Carson & Cradle, of Oro Fino, owners.

Quartz Hill Mine (Hydraulic and Quartz).—This is in Scott's Bar District, about 14 miles W. of Yreka, at an elevation of 400 ft. above the river. The surface paid well to hydraulic, while beneath large bodies of quartz have been exposed, that are being worked. There is a 10-stamp mill on the property, run by steam and water power. See our XIth Report, p. 447. Quartz Hill Mining Company, of San Francisco, owners; — Humphries, of Scott River, Superintendent.

Quigley Mine (Placer).—This is situated on Beaver Creek, about 5 miles from its mouth. W. Quigley, of Walker, owner.

Ramus Mine (Placer).—This mine is on Scott River, about half a mile above its mouth. J. Ramus, of Scott River, owner.

Red Hill Mine (Hydraulic).—This is at Gilta, between the South Fork of Salmon River and Knownothing Creek, and comprises 160 acres. The pit has a 30 ft. bank 200 ft. long, with 12 ft. of gravel next the bedrock, with soil capping. It comprises both a bench and a back channel. Water is obtained from Knownothing Creek, through 3 miles of ditch, carrying 1,500 in. of water, which is delivered through several thousand feet of 15 in. and 11 in. pipe to two giants, using 4½ in. nozzles, under a pressure of from 250 to 300 ft. The best pay is in the 3 ft. of gravel next to the bedrock. The dump is 100 ft. down into the river.

There are two flumes, consisting of 90 and 80 boxes 3 ft. wide, set on a grade of 4½ and 6 in., which are cleaned up once a month, the gold being worth $17 75 per ounce. The company own a sawmill; timber is plentiful. Parker Bros., of Etna, owners.

Reeves, J., Mine (Hydraulic).—This mine is about 8 miles above Happy Camp, on both sides of the Klamath River. See our XIth Report, p. 443. Joe Reeves, of Happy Camp, owner.

Reider Mine (Quartz).—This mine is on the south side of Klamath River, about 8 miles from Hornbrook. The developments consist of an open cut 200 ft. long and 10 ft. deep. J. Prince et al., of Henley, owners.

Reliable Mine (Quartz).—It is in the Hungry Creek District. There are two tunnels 30 and 175 ft. long. J. L. Coyle, of Hornbrook, owner.

Rider & Fabricius Mine (Placer).—This is on Hungry Creek. Rider & Fabricius, of Walker, owners.

Rhinebold Mine (Placer).—This mine is situated on the East Fork of Salmon River. J. J. Rhinebold, of Cecilville, owner.

Roberts Mine (Quartz).—This claim is in Eddy's Gulch, about 5 miles from Sawyer's Bar. E. Roberts, of Sawyer's Bar, owner.

Robinson Mine (Placer).—This is about 6 miles above the mouth of Scott River. J. Robinson, of Scott River, owner.

Robinson Mine (Placer).—This mine is about 4 miles above the mouth of Horse Creek. W. Boles, of Oak Bar, owner.

Santa Teresa Mine (Quartz).—This mine is on Hungry Creek, and has a 10-stamp mill. Staples, Moore & Co., San Francisco, owners.

Sauerkraut Mine (Hydraulic).—This property is on the east side of Salmon River, about 5 miles below Forks of Salmon. Chinese Company, owners.

Saxild Mine (Placer).—It is 3 miles above the mouth of Dutch Creek. J. Saxild, of Gottville, owner.

Schroeder Mine (Quartz).—This mine is in Deadwood Creek, about 7 miles W. of Yreka. It embraces a group of five or six locations. The developments consist of several tunnels and stopes, in all several thousand feet of work. At this mine there are said to be several veins, which vary from 3 to 20 ft. in width. Thirty-five men are employed. There is a 10-stamp mill and two Frue concentrators. J. H. C. Schroeder, of Yreka, owner.

Scott's Mountain (Crawford) Mine (Placer).—This mine is on the East Fork of Scott River. R. Crawford, of Callahans, owner.

Sheffield Mine (Hydraulic).—This mine is on the North Fork of Salmon River, about 2 miles below Sawyer's Bar. E. Sheffield of Sawyer's Bar, owner.

Sheffield Mine (Quartz).—This mine is situated upon the ridge between Eddy's Gulch and White's Gulch, about 4 miles E. of Sawyer's Bar. The developments consist of several thousand feet of tunneling. There are two veins, one a blanket ledge about 8 ft. in width, and another vein, which is 2 ft. wide. There is an 8-stamp mill at this mine, which is run by water power. Sheffield Estate, owners; E. Sheffield, of Sawyer's Bar, agent.

Shell Mine (Placer).—This is in Quartz Valley District. W. Shell, of Fort Jones, owner.

Shiner Mine (Hydraulic).—This claim is about 8 miles below Seiad, on the north side of Klamath River. Shiner Bros., of Seiad, owners.

Short Mine (Quartz).—It is on Trail Creek, a tributary to East Fork of Salmon River. It is said that developments consist of a 100 ft. shaft and a 140 ft. tunnel; vein shows an average width of about 18 inches. W. Walters & Co., of Callahans, owners.

Short Mine (Placer).—This mine is on Trail Creek, a tributary of the East Fork of Salmon River. W. F. Short, of Callahans, owner.

Shumway Mine (Placer).—This is on the North Fork of Salmon River, near Forks of Salmon. Shumway Bros., of Forks of Salmon, owners.

Side Hill Mine (Hydraulic).—This mine is on the South Fork of Scott River. Chinese Company, owners.

Sightman Mine (Hydraulic).—This claim is on the South Fork of Salmon River, about 20 miles above the Salmon. George Sightman, of Cecilville, owner.

Skunk Hill Mine (Hydraulic).—This is about 1½ miles from Scott's Bar. Reynolds & Jacobs, of Scott River, owners.

Smith's Claim (Drift).—This is in the immediate vicinity of Callahans, and comprises 300 ft. of the river front, running 200 ft. back. The gravel is about 25 ft. thick and prospects well. H. Smith, of Callahans, owner.

Smith Mine (Quartz).—It is on French Creek, a tributary of Scott River. It is stated that the developments consist of a 50 ft. shaft and other workings, and that the vein shows an average width of about 2 ft. At this mine there is a 5-stamp mill, run by water power. J. Smith, of Callahans, owner.

Smith Mine (Quartz).—This mine is on the south side of Klamath River, about 4 miles above American Bar. The developments consist of several hundred feet of tunnels and stopes. There is a 5-stamp mill at this mine, run by water power. J. E. Smith et al., of Henley, owners.

Smith Mine (Drift).—This claim is about 6½ miles above Happy Camp, on the north side of Klamath. M. Smith, of Happy Camp, owner.

Smith & Harvey Mine (Placer).—This mine is in Cottonwood District. W. Smith and A. Harvey, of Yreka, owners.

Smith & Marion Mine (Quartz).—This is in White's Gulch, and about 4 miles from Sawyer's Bar. It is stated that the developments consist of a 300 ft. tunnel; the vein is about 3 ft. wide. Smith & Marion, of Sawyer's Bar, owners.

Sniktaw Mines (Placer).—These mines are situated in Quartz Valley District. Fort Jones Mining Company, of Fort Jones, owners; N. H. Smith, President.

Spangler Mine (Placer).—This mine is on Klamath River, at the mouth of Humbug Creek. C. Spangler, of Yreka, agent.

Spencer Mine (Quartz).—See our XIth Report, p. 445.

Squaw Gulch Mine (Hydraulic).—This claim is on Squaw Gulch Creek, a tributary of Scott River. Jean Bolongeot, of Callahans, owner.

Steamboat Mine (Drift).—This mine is on McAdams Creek. Geo. Smith and Jo Stevens, of Etna, owners.

Stearns Mine (Hydraulic).—This mine is on Jackson Creek, a tributary of the South Fork of Scott River. W. H. Stearns, of Callahans, owner.

Steel Mine (Quartz).—This mine is in the Quartz Valley District. There is a 150 ft. tunnel on an 8 to 18 in. vein. Sargent Bros., of Oro Fino, owners.

Sterling Mine (Quartz).—See our XIth Report, p. 446.

Stewart Mine (Hydraulic).—This claim is on Indian Creek. J. Stewart and J. Moore, of Fort Jones, owners.

Stillwell Mine (Placer).—This is 4 miles above the mouth of Horse Creek. — Johnson, of Oak Bar, owner.

Stockton Mine (Drift).—This mine is in Quartz Valley Mining District. The developments consist of a tunnel several thousand feet in length and numerous drifts. Stockton Gravel Mining Company, owners; H. Radbruch, of Fort Jones, agent.

Store Mine (Quartz).—This mine is in Quartz Valley District. There is a 100 ft. incline and a 300 ft. tunnel; the vein varies from 6 to 3 ft. in width. H. J. Diggles, of Fort Jones, owner.

Sugar Hill Mine (Drift).—This is on Fox Creek, a tributary of the South Fork of Scott River. The developments consist of several hundred feet of tunneling. Geo. W. Smith, of Callahans, owner.

Summerville Mine (Hydraulic).—This claim is on the South Fork of Salmon River, 26 miles above Forks of Salmon. Fred Smith & Co., of Cecilville, owners.

Taylor & Maplesden Mine (Drift).—This is at Hamburg Bar, on the south side of the Klamath. A. Taylor and B. F. Maplesden, of Hamburg Bar, owners.

Tea Bar Mine (Hydraulic).—This mine is about 5 miles below Cottage Grove, on the south side of Klamath River.

Thomas & Dupré Mine (Quartz).—This mine is in Hungry Creek. The developments consist of a 30 ft. shaft and a tunnel more than 100 ft. in length. Thomas & Dupré, of Henley, owners.

Thompson Mine (Hydraulic).—This mine is on Hungry Creek. — Thompson, of Coles, owner.

Tiger Mine (Hydraulic).—See our XIth Report, p. 437.

Uncle Sam Mine (Quartz).—This is 7 miles E. from Sawyer's Bar, and comprises 4,500 by 600 ft. The 5 ft. vein courses N. of E. and dips 50° N., between slate and porphyry walls. There is an 8-stamp mill on the ground. E. Sheffield et al., of Sawyer's Bar, owners.

U. S. (Buckhorn Boys') Claim (Placer).—This is 2½ miles below Sawyer's Bar, and is a river claim 1,200 ft. long by 200 ft. wide. The four owners are turning the river at this point. G. A. Moore et al., of Sawyer's Bar, owners.

Van Vector, Perrier & Evans Mine (Placer).—This mine is on Beaver Creek. Van Vector, Perrier & Evans, of Coles, owners.

Volcano Mine (Quartz).—This claim is in Quartz Valley Mining District. The developments consist of an 80 ft. tunnel. The vein shows an average width of about 1 ft. Sargent Bros., of Oro Fino, owners.

Walker Bar Mine (Hydraulic).—This claim is about 14 miles below Happy Camp, on the north side of the Klamath. Chinese Company, owners.

Walker Bar Mine (Placer).—This is about 7 miles below Hamburg Bar, on the south side of Klamath River. Chinese Company, owners.

Weston Mine (Placer).—This property is about 18 miles from the mouth of Thompson Creek. — Weston, of Seiad, owner.

White Mine (Placer).—This is on Humbug Creek. Sam White, of Walker, owner.

White & Rider Mines (Hydraulic).—These are on Little Humbug Creek, about 2½ miles from its mouth. S. White and E. Rider, of Walker, owners.

Wilken Mine (Hydraulic).—This mine is on the East Fork of Scott River. G. Wilken, of Callahans, owner.

Willard & Hickman Mine (Hydraulic).—This claim is one fourth of a mile below Hamburg Bar, on the south side of Klamath River. C. Willard and J. Hickman, owners.

Willey Mine (Hydraulic).—This mine is on Beaver Creek. J. D. Willey, of Coles, owner.

Willheim Mine (Placer).—It is on Wildcat Creek, a tributary of Scott River. — Willheim, of Callahans, owner.

Williams Mine (Hydraulic).—This claim is on the west side of Salmon River, about 6 miles below Forks of Salmon. L. Williams et al., of Forks of Salmon, owners.

Willie Mine (Placer).—This mine is on McAdams Creek. Willie Company, of Etna, owners.

Windeler Mine (Hydraulic).—This claim is on the South Fork of Salmon River, and about 1½ miles above Sawyer's Bar. J. C. Windeler, of Sawyer's Bar, owner.

Wingate Mine (Hydraulic).—This mine is about 9 miles below Happy Valley, on the north side of Klamath River. H. Gasquet, of Gasquet, Del Norte County, owner.

Wood Mine (Hydraulic).—This claim is at the mouth of Thompson Creek, about 7 miles below Seiad, and on the north bank of Klamath River. J. Wood, of Seiad, owner.

Wood, Geo., Mine (Hydraulic).—This claim is about 5 miles above Happy Camp, on the south side of Klamath River. J. Camp, of Fort Jones, owner.

Wright & Fletcher Mine (Hydraulic).—This is in Oro Fino District. Wright & Fletcher, of Oro Fino, owners.

STANISLAUS COUNTY.

The agricultural interests are paramount, and to this end the works of the Turlock and Modesto Irrigation Districts are being hastened toward completion. In the eastern foothills, however, some gold mining is carried on. On the western side of the county borings have been made to prospect petroleum-yielding formations, and in the Mount Diablo range there are deposits of quicksilver, manganese, and coal, which will in time prove valuable.

Ferguson Mines (Drift).—These mines are principally situated on land of the La Grange Hydraulic Ditch and Mining Company, and give employment to 6 men.

La Grange Mining Company's Mines (Hydraulic and Drift).—They are situated on the Tuolumne River, at La Grange. During the winter of 1893–94 about 50 men were employed at these mines, and it is said that the privilege of working the company's ground could be secured in consideration of the miners selling their gold to the company, and buying their supplies at the company's store. See our Xth Report, p. 681.

TEHAMA COUNTY.

Tehama County is situated at the northern end of the Sacramento Valley, and comprises valley, foothill, and mountain lands, nearly in equal proportions.

Owing to its geographical position, this county usually enjoys a larger rainfall than any other county in the Central Valley of California. The valleys and foothills are devoted to agriculture, fruit-growing, and stock-raising. In the mountainous portions of the county the mineral deposits which have hitherto been developed are not numerous, but there is an immense body of chromic iron, for which there appears to be an increasing demand. There are also other minerals which have not as yet been turned to practical account.

In this county there are numerous mineral springs, whose remedial virtues are greatly extolled, the most noted being Tuscan Springs, in the foothills of the Sierra.

In 1889, a ledge of gold-bearing rock was discovered by H. Ragland, on the North Fork of Elder Creek, and about 1½ miles N.W. of the property of the Tehama Consolidated Chrome Deposit Company. Shallow workings developed only low-grade ore, although high assays were said to have been obtained from samples.

TULARE COUNTY.

Although chiefly interested in agriculture, the county has gold-mining interests that have not been fully developed, as well as quarries of undoubted excellence and economic value. There has been a revival in the mining interest in that section of country of which the White River Mining District forms a part, while the foothills furnish building-stone at a point offering many natural advantages. As this county requires irrigation, which depends largely on subterranean sources, and these currents have been subjects of former investigation by the Bureau, we would refer to our XIth Report.

Adams Flat Mines (Placer).—These mines are about 5 miles S. of Auckland P. O., and are usually worked about three months in early spring. A. B. Brown and B. Willis, of Auckland, owners.

Ante-up Mine (Quartz).—It is in Pius Cañon, White River Mining District. In a 12 ft. shaft the vein shows a width of 6 in.; the walls are granitic. Chas. Newby, of White River, owner.

Bald Mountain Mine (Quartz).—This is on Bald Mountain, in White River Mining District. The developments consist of two tunnels, 1,600 and 490 ft. long, and two shafts nearly 200 ft. deep. The vein is 4 to 6 ft. wide, with a 2 ft. pay streak; the walls are granitic. It is furnished with a steam hoist. The ore was formerly worked in a 10-stamp custom mill. J. D. Flaugher, of White River, owner.

Barton Mine (Quartz).—It is in Sec. 21, T. 15 S., R. 25 E., and on Rattlesnake Creek. The developments are a 350 and a 220 ft. tunnel. There is a 50 ft. upraise from the latter. The 3 ft. ledge dips 75° E., in a granitic rock impregnated with quartz and carrying free gold. The country rock is principally syenite, in places schistose, and passes apparently into mica slate. The ore is worked in a 3½ ft. Huntington mill. The tailings contain a black sand, which is said to have shown

a high value by assay. See our XIth Report, p. 491. H. D. Barton, of Auckland, owner.

Black Prince Mine (Quartz).—It is situated in Redwood Cañon, about 10 miles S.E. of Camp Badger, in the Finger Rock Mining District. The developments are a 50 ft. shaft and a 100 ft. tunnel. The vein is nearly 5 ft. wide. E. Walters, of Camp Badger, owner.

Blue Bird Mine (Quartz).—This mine is in Finger Rock Mining District, about 12 miles from Camp Badger. The developments consist of tunnels 65 to 120 ft. in length. Kirkland Bros., of Auckland, owners.

Blue Mountain Mine (Quartz).—The claim is on the western slope of Blue Mountain, in White River Mining District. The vein, 14 in. wide, is nearly vertical, and courses N.E. and carries free gold with sulphurets. J. C. McDonald, of White River, owner.

Clara Gibbons Mine (Quartz).—This is in Chileno Gulch, in White River Mining District. Developed by a 24 ft. shaft and open cuts. The vein varies in thickness from a few inches to about 2 ft., and dips about 45° S.E. The quartz shows galena and iron pyrites. The walls are granitic. C. H. Gibbons and A. Bowen, of White River, owners.

Domingo Mine (Quartz).—This claim is in the Finger Rock Mining District. E. Walters, of Camp Badger, owner.

Eastern Extension of the Isian Peak Mine (Quartz).—This is situated in the White River Mining District. M. G. Ford, of White River, owner.

Eclipse Mine No. 2 (Quartz).—It is in White River Mining District. The developments consist of a 250 ft. tunnel and a 130 ft. winze, also extensive stopes. The vein, 8 to 18 in. wide, dips about 60° W. of N. The hanging-wall is granite and the foot-wall a granitic schist, passing into mica slate. White River Mining Company, of London, England, owners; B. Allen & Co., of White River, lessees.

Ely Mine (Quartz).—This claim is in Sec. 27, T. 24 S., R. 29 E., White River Mining District. There is a 110 ft. shaft, on a 4 to 10 in. vein. Ross Keller, of White River, owner.

Eschscholtzia Mine (Quartz).—It is on Lime Creek. There are two short tunnels on a 10 in. vein.

Golden Treasure Mine (Quartz).—This is in Chileno Gulch, in White River Mining District. Developed by two open cuts. The vein is about 1 ft. wide and dips 20° S.E. The walls are granitic. J. Jacombs, of White River, owner.

Good Enough Mine (Quartz).—This claim is on the north bank of White River, in White River Mining District. The developments consist of a 110 ft. shaft, with stopes. R. Keller, of White River, owner.

Gray Eagle Mine (Quartz).—This claim is in the Finger Rock Mining District. There is an 80 ft. tunnel and a 60 ft. shaft.

Hard Tack Mine (Quartz).—It is in White River Mining District. The shaft is 30 ft. deep on a 6 in. vein. Norman Brown, of White River, owner.

Hard Times Mine (Quartz).—This is in Chileno Gulch, White River Mining District. Developed by a 70 ft. tunnel and an open cut. The vein is 3 to 6 in. wide, and dips 30° S. J. Jacombs et al., of White River, owners.

Harvest Home Mine (Quartz).—It is in White River Mining District. There are two shafts, 40 and 60 ft. deep, and a tunnel 40 ft. long. The vein is 6 to 18 in. wide. C. Wilbern, of White River, owner.

Hidden Treasure Mine (Quartz).—It is in White River Mining District. The vein is 1 to 6 in. wide, and dips 30° S.E. T. F. Owens et al., of White River, owners.

Homestake Mine (Quartz).—This claim is in White River Mining District. The developments consist of a 300 ft. and a 125 ft. tunnel, connected by a 46 ft. upraise. The vein is 3 to 12 in. wide, and dips 80°. At this mine there is a 5-stamp mill. D. W. Grover and W. H. Duke, of White River, owners.

Isian Peak Mine (Quartz).—This claim is near Grizzly Gulch, in White River Mining District. There is a 25 ft. shaft; the vein is 6 to 12 in. wide. G. Dover, of White River, owner.

Keys Mine (Quartz).—This claim is on the South Fork of Tule River, in White River Mining District. Developments consist of three shafts, 100, 60, and 25 ft. deep, with sundry levels and stopes. H. A. Harris, of White River, owner.

Last Chance (*Redfield*) *Mine* (Quartz).—This is on Bald Mountain, in White River Mining District. The developments consist of a 300 ft. tunnel and a 100 ft. shaft, with stopes. The vein is about 4 ft. in width, with granitic walls. J. D. Flaugher, of White River, Superintendent.

Lucky Cuss Mine (Quartz).—This claim is in White River Mining District. Developed by a 100 ft. tunnel; the vein varies from a few inches to 3 ft. in width. B. Allen, of White River, owner.

Mammoth Mine (Quartz).—This claim is on the Middle Fork of Tule River, about 40 miles E. of Lindsay, on the S. P. R. R. There is a 30 ft. tunnel; the vein is said to be 4 ft. in width. J. Goldstein, of Lindsay, owner.

Mineral King Mines.—These mines are situated in the high Sierra, at a distance of about 60 miles by road in a northeasterly direction from Visalia. See our VIIIth Report, p. 646.

Old Soldier Mine (Quartz).—This mine is situated in Drum Valley, and is said to yield garnets, topazolite, epidote, and tourmaline.

Otter Mine (Quartz).—This mine is in Coarse Gold Gulch, in White River Mining District. There is a 100 ft. and a 60 ft. shaft, which are now partly filled with water. J. W. Beaver et al., of White River, owners.

Page Mine (Quartz).—This claim is 7 miles N.E. of Visalia, in Sec. 17, T. 18 S., R. 26 E. There are two small prospect shafts on a vein several feet in width, which appears to be formed by silicious infiltrations impregnating the country rock. The vein can be traced for several miles and dips 80° S.E. J. E. Prothers, of Visalia, owner.

Pincher and Bulger Mine (Quartz).—It is on Lime Creek, a tributary of the Kaweah River. The developments consist of a 70 ft. incline and a 150 ft. tunnel. The vein averages 3 ft. wide. J. Edwards and D. R. Stevens, of Visalia, owners.

Redfield Mine.—See Last Chance Mine.

Richelieu Mine (Quartz).—In White River Mining District. Developed by a 90 ft. shaft and a 100 ft. tunnel. The vein is about 2 ft. wide and dips 80° N. in granite. J. D. Flaugher, of White River, owner.

Sarah Tucker Mine (Quartz).—It is in White River Mining District. A short tunnel shows a vein 8 in. to 2 ft. wide. C. Briggs, of White River, owner.

Simmons Mine (Quartz).—This is an eastern extension of Bald Mountain Mine. The ledge now shows a width of about 3 ft. in the

bottom of a 50 ft. shaft. J. E. Dunlap and W. Davis, of White River, owners.

Stancil Mine (Quartz).—It is on Bald Mountain, in White River Mining District. Opened by a 500 ft. tunnel, with stopes. The main vein is 6 to 18 in. wide, and dips 80° N. The quartz carries some sulphurets. There are two other veins in this mine, the course of which does not coincide with that of the main lode. J. D. Flaugher, of White River, Superintendent.

Sunset Mine (Quartz).—In White River Mining District. The vein is 7 to 18 in. wide, in micaceous slate walls. T. J. Mayfield, of White River, owner.

Vulture Mine (Quartz).—This claim is in White River Mining District, and is an eastern extension of the Grizzly. The developments consist of a 340 ft. and an 80 ft. shaft; also various drifts and stopes. The width of the vein varies from 6 in. to 4 ft. The ore shows sulphurets and free gold. A. R. Sorrells, of White River, owner.

Way-up Claim (Placer).—It is on Ten-Mile Creek, in Finger Rock Mining District, about 20 miles N.E. from Camp Badger. E. S. Balam, of Camp Badger, owner.

W. Hart Mine (Quartz).—In Finger Rock Mining District, and is a southern extension of the Gray Eagle. W. Hart, of Camp Badger, owner.

White River Mining District.—The country rock is principally syenite, with one or more streaks of crystalline limestone. These streaks have a northeasterly and southwesterly trend. Accompanying the limestone are copper-bearing rocks. The auriferous veins traversing the syenite are fissure veins, and the prevailing dip is southwesterly. In the western portion of the district a micaceous slate forms what is locally known as the "slate range," and some mines are situated thereon.

TUOLUMNE COUNTY.

In Tuolumne County a decided impetus has been given to the mining industry, both by new discoveries in mines already in operation, and by reopening properties which have long been idle. Heretofore more attention was given to "pocket mining" than to mines which yield a comparatively low grade of quartz, and require mills; but the list of properties supplied with mills is largely augmented, and accessions are constantly being made. Numerous transfers of mining properties are being recorded, and Tuolumne advances with its neighbors.

Ah Mow Mine.—It is 1 mile N.W. of Columbia, on the "white gravel leads." In the summer of 1893, 12 Chinese were working a large pit having a superficial area of nearly 10,000 ft. and a depth of 80 ft. The gravel was hoisted in large frame boxes by a huge derrick at the top of the pit. Most of the material of this lead is white quartz. The once nearly or quite horizontal bed has been lifted and faulted until now it has a steep pitch like a vein. The edges of the faulted deposit are turned upward at the center, the gravel dipping both ways from the fault plane. The deposit is overlaid with white volcanic ash (tufa), the stratification of which shows the folding and faulting of the beds more plainly than the layer of gravel.

Alabama Mine (Quartz).—It is 1½ miles W. of Jamestown, on the "Mother Lode." See our Xth Report, pp. 53 and 741. A brush fire communicated with the hoisting works in 1893 and destroyed them.

Alameda Mine (Quartz).—One mile N.W. of Jamestown, on the "Mother Lode." M. B. Harriman, of Sonora, owner.

Alta Mine (Quartz).—See our Xth Report, p. 757.

App & Heslep Mine (Quartz).—It is on Quartz Mountain, 1 mile S.E. of Jamestown. See our VIIIth Report, p. 660. In 1893 the water was taken out of the shaft with a view of resuming operations. Martin, Ballard & Neville, of Jamestown, owners.

Argentum Mine (Quartz).—It is located in the American Camp District, 10 miles N.E. of Sonora. The developments show two veins, separated by 4 ft. of dike rock; both outside walls are black slate. The quartz contains iron and lead sulphurets and occasionally zinc-blende. J. B. Pownall, of Columbia, owner.

Belcher Consolidated Mine (Quartz).—It is 1½ miles N.W. from Groveland. See our VIIIth Report, p. 672. Belcher Consolidated Mining Company (Limited), of London, England, lessees.

Belle View (Hyde) Mine (Quartz).—See our Xth and XIth Reports, pp. 755 and 501. It is 6 miles N.E. of Sonora, and for a number of years lay dormant, but in 1889 work was resumed and has been successfully prosecuted ever since. Belle View Mining and Agricultural Company, owners.

Big Oak Flat Region consists of a granitic area almost if not completely surrounded by slates and schists and other metamorphic rocks. In this region are several large quartz veins, on which are the Cosmopolite and Mississippi mines. The vein system is somewhat intricate, as they strike in various directions, and frequently intersect. Nearly all the veins cross the granite, reaching into the slates. Gold is found in all the veins, but usually in small amounts, and the "tellurides" are found in the Conrad vein, on the east side of Big Oak Flat. The Mississippi vein lies near the west border of the granite. It is a large, well-defined vein, but low grade.

Black Oak Mine (Quartz).—It is three fourths of a mile S.W. of Soulsbyville. The property also includes the Live Oak Mine. See our VIIIth, Xth, and XIth Reports, pp. 665, 744, and 500. Since then the shaft has reached a depth of 600 ft. and new levels were run. The quartz carries considerable iron, zinc, lead, and copper sulphurets, and magnetic iron pyrites (pyrrhotite). Scott, Dowe & Co., of Soulsbyville, owners.

Bonanza Mine (Quartz).—This property, at Sonora, has won the reputation of being the most prolific producer of "pocket gold" in the world. Descriptions and other information concerning it may be found in our VIIIth, IXth, Xth, and XIth Reports, pp. 652, 736, and 511. Since our last publication the workings have reached a depth of 1,300 ft. on the incline. The pockets have ranged from $4,000 to $300,000, usually being between $20,000 and $50,000. The Bonanza vein, as it may be called, is a dike of light greenish-gray rock of felsitic texture, containing frequently chloritic scales. In width it varies from 8 to 16 ft. It strikes N. 30° E., dips 20° to 25° E., and is the youngest dike in the region, cutting all older dikes. The slates, which are intruded by the dike, strike N. 30° W., and dip 65° to 70° N.E. Though the Bonanza dike traverses older dikes and several varieties of metamorphic rocks and limestone, the gold is only found associated with a pyritous slaty zone, 4 to 12 ft. in width. On the west side of this is an argillite with slaty cleavage, but having comparatively massive structure. On the

east side is a dense quartzose rock, locally called trap, though in fact a metamorphic sedimentary rock. Within the belt of pyritous black slate occur four seams not over 3 in. in width at any place, and usually but a small fraction of an inch. One of these fissures separates the pyritous slate from the more massive slate on the west side. The others are within the black slate itself. The strike of these seams varies but little, being practically parallel and conforming to the strike of the slates. Occasionally in the west crevice, quartz may be found in the form of a little vein, and again a thin sheet of decomposed rock of undoubted eruptive origin. These small fissures are called "crossings."

A second series of seams strike into the dike from the hanging-wall side, cutting slates and other rocks in both strike and dip. These seams all pitch southwestward, and are known as "gold seams."

The dike includes, in the upper portion of the mine, three veins of quartz, one of which lies on the hanging-wall or upper side, one on the bottom, and the third about the middle. The sheets of quartz conform to the strike and dip of the dike. In thickness they vary from an inch or two to 2 ft. In the lower workings the quartz appears to have been concentrated in the central portion of the dike, separated from the slates above and below by 4 to 10 ft. of dike rock. No gold is found in this lower portion of the mine. The slates are, moreover, greatly disturbed by the intrusion of large dikes of diorite, which here almost exclude the slates.

The Bonanza dike is a plane of movement as well as of displacement, the hanging-wall having moved upward and to the west relatively to the foot-wall. This diagonal movement is almost exactly 16 ft. in either direction. The "crossings" and "gold seams" are found in the slates of the foot-wall as well as on the hanging-wall, showing them to be older than the dikes.

As previously stated, all the gold found in this mine was discovered within the narrow belt of black pyritous slate either on the hanging-wall or foot-wall side at contact with the quartz, or in the central quartz vein midway between the walls. Gold is only found, even in the places mentioned, where a "crossing" and a "gold seam" intersect on the plane of the quartz veins. The "crossings" and "gold seams" each continue through the dike, though in a somewhat erratic manner. Another and most remarkable thing is that the pockets of gold were found at alternate crossings or seams. It was found, during the years of operation of this mine, that these pockets of gold were distributed with almost mechanical regularity. Bonanza Mining Company, of Sonora, owners.

Buchanan Mine (Quartz).—It is on the summit of a high ridge on the northern side of the Middle Fork of Tuolumne River, about 10 miles E. of Sonora. It is on the "east lode." See our VIIIth, Xth, and XIth Reports, pp. 666, 752, and 494. In 1893 a drift to connect with old workings was being driven. Davis & Barron, of San Francisco, owners.

Canondale Mine (Placer).—It is in Columbia. Diego Lorenzo & Co., of Columbia, owners.

Carlotta Mine (Quartz).—This is half a mile N.W. of Summersville. See our XIth Report, p. 499.

Chaparral Mine (Quartz).—It adjoins the Buchanan Mine, 10 miles east of Sonora. See our XIth Report, p. 496.

Colin & Basovitch Mine (Placer).—This is 2 miles E. of Columbia. In this vicinity are several shallow placer claims, which are worked by the ground-sluice method, and some deep pits, from which the gravel is hoisted by water-power derricks, dumped in large puddling bins, where it is disintegrated by powerful streams from "giants," and the gravel then passed into sluices. Colin & Basovitch, of Columbia, owners.

Colin & Graham Mine (Quartz).—It is 2½ miles S.E. of Columbia, near Sawmill Flat. The mine is being reopened. It is equipped with a hoist and a 4-stamp mill. The vein is from 1 in. to 3 ft. in width. The walls are mica schist, with frequently an intrusive mass of felsitic rock, much decomposed. The shoots of quartz are extremely irregular, but the rock is of good grade. Colin, Graham & Co., of Columbia, owners.

Columbus Mine (Quartz).—This is in Cherokee, 7 miles N.E. of Sonora. It occurs on a "swell" in the vein, caused by the deposition of a large lens of quartz on the hanging-wall side of the main fissure. It has walls of hornblende granite. After an idleness of twenty-five years, the mine is now being reopened. This mine and those near it all belong to the "east lode" series. The foot-wall vein is massive, and is separated by 12 ft. of broken rock and quartz from the hanging-wall vein. Capt. Johns, of San Francisco, lessee.

Confidence Mine (Quartz).—It is 4½ miles N.N.E. of Soulsbyville. See our XIth Report, p. 503. R. Chute, of San Francisco, owner.

Conrad Mine (Quartz).—See Big Oak Flat region. A. Conrad, owner.

Consolidated Eureka Mines (Quartz).—This property, in Summersville, comprises the Eureka and Dead Horse claims. The latter is in operation. These mines, which are in the "east lode," are described in our VIIIth, Xth, and XIth Reports, pp. 664, 750, and 498. A notable fact concerning this mine is that the best quartz is found in contact with a granite dike, which at places accompanies the vein. The country rock is mica schist and mica slate. The granite dike seldom continues in contact with the vein for more than 60 ft. The walls are plainly striated, the grooves pitching S.E., which is also the direction of the pitch of the pay shoot. A dike of diabase occurs near the Eureka Mine, a short distance N.W. of the Dead Horse. It is said that a rich pay shoot was found in close proximity to this dike. Alvinza Hayward, of San Francisco, owner.

Consuella Mine (Quartz).—This is on the south side of the North Fork of Tuolumne River, a mile S.E. of Summersville, and is on the "east lode." Formerly well equipped, it has now been idle for years. The vein is from 1 to 16 ft. in width; average, 5 ft. There are two pay shoots, one of which is 80 ft. long; the other is known to be 40 ft. in length, and it may be longer. D. B. Warfield, of Oakdale, owner.

Cosmopolite Mine (Quartz).—It is half a mile S.E. of Big Oak Flat. The vein strikes N. 10° E. and dips 45° W; it has been extensively worked in its upper portion. The mine is working now under a lease. The east and west ends of the vein are in slates, and the middle portion in the granite of Big Oak Flat basin. A granitic dike accompanies the vein in that portion having slate walls. Poole, Reid & Co., of Groveland, lessees.

Darrow Mine (Quartz).—It is 5 miles W. of Sonora. It is a "pocket" vein, occurring in diabase. A small number of men are employed. Darrow & Co., of Sonora, owners.

Dead Horse Mine (Quartz).—See Consolidated Eureka.

Dutch Mine (Quartz).—See our Xth Report, p. 51. Working in 1893.

Eureka Mine (Quartz).—It is near Sonora, on the Jamestown road. The vein is 4 ft. wide, in slate, which changes to chloritic schist about 20 ft. below the surface. Fitzgerald & Co., of Jamestown, owners.

Eureka Mine (Quartz).—See Consolidated Eureka.

Florence Mine (Quartz).—This is 5 miles W. of Sonora, and about 4,000 ft. E. of the "Mother Lode." It is a recent discovery, and consists of quartz seams in a mineralized dike of felsitic rock, the upper portion being much decomposed and containing free gold. The hanging-wall rock of the dike is diabase, through which a 120 ft. tunnel was driven toward the vein. The foot-wall side has a slaty structure, but is probably altered diabase, too much decomposed to determine. Bromley & Orlando, of Sonora, owners.

Ford Mine (Quartz).—See Page.

Garfield and Virginia Mines (Quartz).—These are 12 miles E. of Sonora, near the Buchanan Mine, on the north side of the Main Fork of Tuolumne River. The group is on the "east lode," and are well situated for economical mining and milling. Garfield-Virginia Mining Company, of Sonora, owners.

Garrett Mine (Quartz).—See Page Mine.

Gem Mine (Quartz).—It is on the "Mother Lode," 1½ miles N.W. of Jamestown. See our VIIIth and Xth Reports, pp. 663 and 742.

Gem Mine (Quartz).—It is 3 miles N.W. of Columbia. It has a 10-stamp mill and hoisting works, run by water under a high head.

Golden Gate Mine (Quartz).—It is 1 mile S.E. of Sonora. See our Xth and XIth Reports, pp. 738 and 511. Since the last report the developments have been carried nearly 200 ft. deeper. A very complete canvas plant for saving the slimes escaping the vanning machines has been erected, and resulted in a very large saving of material, which would otherwise have been lost. The vein varies from a small seam to 20 ft. in width, occurring entirely in diorite. The quartz and auriferous sulphurets have been deposited in a zone of crushed rock along the sides of a plane of faulting. In some places the vein or fissure exhibits a branching tendency, but the main crevice is usually well defined. The diorite has a slaty, schistose, or splintery structure on either side of the fissure. The mine is strongly timbered. No "colors" can be obtained by panning, as the gold is contained almost exclusively in the sulphurets. Golden Gate Mining Company, of Sonora, owners.

Grizzly Mine (Quartz).—It is about 1½ miles S.E. of Summersville, on the "east lode." John Leachman, of San Francisco, owner.

Grizzly Mine (Quartz).—This is 1 mile N. of Priest's Hotel, on the Yosemite road, and 1½ miles N.W. from Big Oak Flat. It is a "pocket mine," and in operation. James & Harper, of Big Oak Flat, owners.

Henrietta Mine (Quartz).—It is 4 miles N.E. of Summersville, on the North Fork of the Tuolumne River. The vein is 4 to 5 ft. wide. The developments consist of a 50 ft. shaft and a 130 ft. cross-cut tunnel. The quartz contains a heavy percentage of iron and lead sulphurets. C. F. Haslam, owner.

Heslep Mine (Quartz).—See App Mine.

Holmes Mine (Quartz).—See Miller Mine.

Hunter (*Todd & Hunter*) *Mine* (Quartz).—It is 10 miles E. of Sonora and half a mile N.W. of the Buchanan, on the "east lode." It is

equipped with hoisting and milling machinery. J. P. Sullivan, of San Francisco, owner.

Hyde Mine (Quartz).—See Belle View Mine.

Isabella Mine (Quartz).—It is 1½ miles N.W. of Jamestown, on the "Mother Lode."

Kanaka Mine (Quartz).—It is 6 miles E. of Groveland, on the "east lode." See our VIIIth Report, p. 669. In 1893 a new level was being opened in the lowest workings. Most of the quartz milled at that time was being stoped from the upper levels. A deep cross-cut tunnel to drain and still further develop the property was under consideration. Louis Cassaretto, of Groveland, owner.

Keltz Mine (Quartz).—It is 10 miles N. of Soulsbyville, near Elizabeth Peak, on the South Fork of the Stanislaus. This mine is on the "east lode," and is one of the most important on that belt. See our Xth and XIth Reports, pp. 755 and 504. The description of the Hite Mine covers the geological characteristics of this mine. Since the issuance of the last report 10 stamps have been added to the mill, making 20 stamps in all, with a capacity of 35 tons daily. The vein is from 1 to 10 ft. wide. Leechman Prospecting Company, of San Francisco, owners.

Knox & Boyle Mine (Quartz).—See our Xth Report, p. 51. Working in 1893.

Kriss-Cross Mine (Quartz).—It is 1 mile N. of Priest's Hotel, on the Yosemite stage road, and 2 miles N.W. of Big Oak Flat. A shaft 50 ft. deep has exposed two veins, one of 22 in. and one of 14 in. in width, separated by a foot of barren slaty material. It is a new prospect, located in 1893. Hughes & Brown, of Chinese Camp, owners.

Lady Washington Mine (Quartz).—This is half a mile S. of Summersville, and is on the southeast extension of the Consolidated Eureka Mines. See our Xth and XIth Reports, pp. 752 and 498. A large amount of development shows this to be a promising mine. It was said that operations were to be resumed in the fall of 1893. Geologically it is quite similar to the Dead Horse, which it joins. F. H. Hill, of Summersville, lessee.

Laura and North Star Mines (Quartz).—They are on the "east lode," between Cherokee and Summersville. See our XIth Report, p. 498. After an idleness of several years operations were resumed on these mines in the summer of 1893.

Live Oak Mine (Quartz).—See Black Oak Mine.

Longfellow Mine (Quartz).—This is near Big Oak Flat. See our VIIIth and XIth Reports, pp. 672 and 494. D. Longfellow, of Groveland, owner.

Lumsden Mine (Quartz).—It is half a mile S.E. of Priest's Hotel, on the Yosemite road. The veins occur in a soft, black, pyritous slate. A long drain tunnel reaches a vertical depth of 50 ft. A large amount of gold has been sluiced from the surface and found in pockets in the several veins, accompanied by dike rocks. See our XIth Report, p. 494. The owners work only during the winter season. D. Lumsden & Son, of Big Grove Flat, owners.

Martha Washington Mine (Hydraulic and Drift).—It is on Table Mountain, 5 miles W. of Chinese Camp. The corporation owning this property is composed of California ladies. Operations were suspended in 1893. Martha Washington Gravel Mining Company, of Oakland, owners.

Meade Mine (Placer).—In Columbia. Working. G. L. Meade, of Columbia, owner.

Miller & Holmes Mine (Quartz).—It is on Quartz Mountain, 1½ miles S.E. of Jamestown. There are two veins in this property, 170 ft. apart. As development had just begun in 1893, little can be said of this property, excepting that its characteristics are those common to this portion of the "Mother Lode." Miller & Holmes Mining Company, of Jamestown, owners.

Mississippi Mine (Quartz).—See Big Oak Flat region. John McLaughlin, of Coulterville, Mariposa County, owner.

Monitor Mine (Quartz).—It is on the North Fork of Tuolumne River, 3 miles W.N.W. from the Confidence Mine. Work was resumed in 1893, after a long period of idleness. John Neal & Co., of Sonora, owners.

Mount Jefferson Mine (Quartz).—It is at Groveland. The vein occurs in mica slate, with a dike of granitic character. The property was once a large producer, but has now been idle for years. It is said that the mine will be reopened soon. The vein at one place was 25 ft. wide. The lack of sufficient knowledge of timbering at the time the mine was worked resulted in a disastrous cave. The greatest depth is said to be 265 ft. It is claimed that the ore shoot below this level is intact. J. H. Brown, of Boston, Mass., owner.

Mount Zion Mine (Quartz).—It is 1 mile E. of Groveland. Operating in 1893 for a short time, but is now idle. Foot et al., of Groveland, owners.

Neversweat Mine (Quartz).—It is 1 mile N.W. of Big Oak Flat, and appears to be the north end of the Mississippi vein. Fault planes are numerous. The gold in this mine occurs in "pockets," always where the main vein is intersected by a seam or "crossing." James Valentine, of Groveland, owner.

Neversweat Mine (Quartz).—It is 1 mile N. of Columbia. It is a "pocket" mine also, and is worked by Peterson & Keefe, of Columbia, owners.

New Albany Mine (Quartz).—It is 1 mile N.E. of Summersville, in the cañon of the North Fork of the Tuolumne River. See our VIIIth, Xth, and XIth Reports, pp. 665, 752, and 497. The mine was reopened in 1893. — Ballard et al., lessees.

New Year's Mine (Quartz).—About 1 mile S.E. of Summersville. It is on the "east lode."

North Fork Mine (Quartz).—It is 3 miles E. of Soulsbyville. The vein has a curving strike where developed, the bow being to the south. At either end of this crescent-shaped vein the dip is considerably greater than in its center, where it is 45°. All the workings on this vein show the quartz to have been cut off at a common plane. The fault appears to extend through the hill to mines on the opposite side. A new shaft was being sunk in 1893, and it is reported that the vein has been found below the fault. Should this prove to be the case and the quartz rich enough to pay, it may result in several mines being reopened which were rich at the surface, but in which the veins were faulted. The formation in which this mine and other prospects on the mountain occur is mica schist, quartzite, and slates, intruded by felsitic and granitic dikes. Thos. Soulsby, of Soulsbyville, owner.

North Star Mine (Quartz).—See Laura Mine. — Oliver et al., of Sonora, owners.

O'Hara Mine (Placer).—In Columbia. Working. A. O'Hara & Co., of Columbia, owners.

O. K. Mine (Quartz).—One mile N.W. of Jamestown, on the "Mother Lode." R. Chute, of San Francisco, owner.

Old Tuolumne Mine (Quartz).—It is in Wet Gulch, 3 miles N.E. of Columbia. A small force of men were engaged in 1893 driving a tunnel, then 1,700 feet long, on the crevice, to reach a shoot of rich quartz which crops on the surface. R. C. Davis, of Columbia, owner.

Ophir Mine (Quartz).—This is 1 mile N.W. of Big Oak Flat. It has a very remarkable geological structure. It lies in a nearly horizontal sheet, varying in thickness from an inch to 2 ft. The crevice intersects slates which are nearly perpendicular, striking N. 75° W. A fault has displaced this horizontal vein, dropping the east side nearly 3 ft. The direction of this fault plane is nearly parallel with the strike of the slates. The gold is found in the crushed quartz and slaty rock in the small space between the ends of the displaced vein. In addition to the coarse gold of the "pockets," considerable high-grade milling rock is found. J. P. James, of Groveland, owner.

Page Mine (Quartz).—It is 1 mile N. of Sonora, on the west side of Bald Mountain. It is leased for a term of years by the Bald Mountain Tunnel Company, of Sonora. The rocks are partly metamorphic, mica schist, slate, quartzite, etc., and partly eruptive, diorite-porphyrite, and felsitic dikes. These latter accompany the vein. The fissure varies from a seam to 3 ft. in width. Aside from the pockets the quartz is absolutely barren. As usual in "pocket mines," the gold is found where seams intersect the main vein.

The most valuable deposits have been found where a nearly horizontal seam cuts the fissure at points where a nearly vertical seam strikes across the vein. In nearly all the pocket mines in this portion of California, the gold occurs at points where three planes intersect, viz.: the main crevice; a seam having a strike parallel or nearly so by cutting the vein in dip; and a crossing seam striking at a high angle across the main fissure, though having a greatly varying dip. The most productive are those which approach the vertical. It is true there are exceptions, but the conditions stated constitute the rule. On the other hand these favorable conditions obtain at times and no gold is discovered. The dike rocks also appear to influence the deposition of the gold. In several cases in the Page Mine gold was discovered attached to the felsitic dike rock.

Other pocket mines on Bald Mountain having characteristics similar to the Page Mine are the Ford, Garrett, Sugarman, and Wilson. Prospectors are always traversing this section of the country in search of pocket mines, which are usually discovered by prospecting the surface soil.

Patterson Mine (Quartz).—At Tuttletown, 3 miles N.W. from Jamestown. See our VIIIth Report, p. 656.

Piute Mine (Quartz).—It is a "prospect," near the Henrietta. It is bonded and being developed. C. F. Haslam, of Sonora, owner.

Philadelphia Diggings (Hydraulic).—They are 10 miles N. of American Camp, and enjoyed a long season of prosperity, but have been closed down for years. W. H. Sharp & Co., of San Francisco, owners.

Platt & Gilson Mine (Quartz).—This is in the town of Soulsbyville. See our VIIIth and Xth Reports, pp. 666 and 746. W. Sharwood, of Soulsbyville, owner.

Puerto Fino Mine (Quartz).—This is near the village of Cherokee. See our XIIth Report, p. 499. W. Sharwood, of Soulsbyville, owner.

Rappahannock Mine (Quartz).—It is 1½ miles N.W. of Jamestown, on the "Mother Lode." R. Chute, of San Francisco, owner.

Rawhide Mine (Quartz).—It is 2½ miles N.W. of Jamestown, on the Rawhide ranch. See our Xth and XIth Reports, pp. 54 and 507. Since our last report the main shaft has been sunk to the 400 ft. level and levels run. Very rich rock was struck during the fall of 1893. The new 40-stamp mill has been completed, and it is thoroughly equipped with all modern machinery. It is run by water, but with a very light pressure. Guild Gold Mining Company, owners; W. E. Nevills, of Jamestown, manager.

Rawhide Mine No. 2 (Quartz).—It lies S.E. of the Rawhide. It is undeveloped. Hayward & Hobart (estate), of San Francisco, owners.

San Guiseppe Mine (Quartz).—It lies 1 mile W. of Sonora. See our VIIIth and Xth Reports, pp. 654 and 740. It is in active operation. Excepting additional development, the conditions at the mine are much the same as when last reported. The ore shoots occur in altered diorite-porphyrite, and are without well-defined walls or limits. This mine produces the purest vein gold in California. San Guiseppe Mining Company, of Sonora, owners.

Santa Maria Mine (Quartz).—It is 20 miles S.E. of Groveland, on the Yosemite road, near Crocker's Inn. It has an 18 in. vein of high-grade quartz. John Neale, of Sonora, owner.

Saratoga Mine (Quartz).—This is about half a mile N.W. of Sonora. See our Xth Report, p. 737. The fissure is a simple crevice, cutting slates, schists, quartzite, limestone, and diorite dikes, being accompanied by a light-colored felsitic dike. The vein strikes N. 40° and dips 65° to 70° N.W. The country rocks strike N. 25° W. and dip N.E. Although the vein cuts several varieties of argillaceous, calcareous, silicious, and magnesian rocks, gold is only found in the vein where it cuts the black slates. The fissure is a plane of displacement, the rocks of the foot-wall being found on the hanging-wall side 30 ft. southwestward. The usual "gold seams," parallel with the vein, and cutting it in dip, and the "crossings" which lie parallel with the slates, are always found accompanying "pockets" in this mine. J. T. Faxon, of Sonora, owner.

Silken Mine (Quartz).—This is 1 mile N.W. of Big Oak Flat. The vein, striking N. and dipping 42° W., has a "shoot" in which "pockets" occur, and it is 30 ft. long, 1 to 5 ft. wide, and pitches 45° N. In depth the vein becomes much flatter. The slates strike E. and W. and dip 80° S. The usual "gold seams" and "crossings" occur. C. P. Hall, of Big Oak Flat, owner.

Sonora Consolidated Mine (Quartz).—It is 1½ miles E. of Cherokee. See our Xth Report, p. 748. John Neale, of Sonora, owner.

Soulsby Mine (Quartz).—It is in Soulsbyville. See our Xth Report, p. 742. It was still idle in 1893, but there was some talk of reorganization and reopening this once famous mine, which has been one of the most important on the "east lode." The vein is in hornblende granite, and a dike of light-colored rock, having a felsitic texture, accompanies the vein. W. Sharwood, of Soulsbyville, owner.

Sugarman Mine (Quartz).—See Page Mine. J. H. Neale, of Sonora, owner.

Todd & Hunter Mine (Quartz).—See Hunter Mine.

Virginia Mine (Quartz).—See Virginia Consolidated Mine.

Wheeler Mine (Quartz).—In Big Oak Flat; worked intermittently. See Cosmopolite. O. Fisk, of Coulterville, Mariposa County, owner.

Wilson Mine (Quartz).—See Page Mine.

Winchester Mine (Placer).—In Columbia. Working. Julia Winchester, of Columbia, owner.

TRINITY COUNTY.

On account of the comparatively small amount of agricultural land along the rivers of this county, and their emptying directly into the ocean, the numerous gravel deposits have been worked without hindrance by the hydraulic process, keeping the gold output of the county up to a high figure. Within the last year foreign capital has been brought in for the development of the heavier bodies of gravel. The quartz developments have not kept pace with the gravel workings. This is not so much from an absence of profitable mineral-bearing veins as from the roughness of the country and the lack of good wagon roads through the mountain districts, which add greatly to the expenses of acquiring the necessary machinery for the reduction of ores. The success of the Brown Bear and adjacent mines shows what may be expected in this direction when more thorough prospecting has been done. Closer prospecting along the serpentine belt that passes through the country past the Altoona Quicksilver Mine toward Salmon River will undoubtedly reveal further bodies of cinnabar; its presence is plainly indicated near the Black Bear Mine, in Siskiyou County, although the ore in place has not been developed. For the genuine prospector this is a field that should well repay a careful and thorough investigation.

Bartred Mine (Quartz).—See our VIIIth Report, p. 638.

Begel & Day Placer Mine (Hydraulic).—This claim is on Cañon Creek, half a mile S. of Dedrick. Messrs. Begel & Day, of Dedrick, owners.

Berger Claim (Hydraulic).—This is 4 miles S. from Dedrick, on Cañon Creek. — Berger, of Dedrick, owner.

Bloss & McClary Mine (Hydraulic).—See our Xth Report, p. 699. It is at Trinity Center, and comprises 600 acres of ground. Only 300 acres of this ground can be worked without elevating, and the dumping ground for that amount is not favorable, being only 40 ft. The present bank is about 80 ft. high, with 800 ft. frontage, carrying from 12 to 20 ft. of gravel and soil capping. A part of the gravel next to the bedrock in the deeper portions of the channel is cemented, and a stratum of sandstone shows in portions of the bank. Water to the amount of 600 in. is conveyed through an upper ditch 7 miles long, and 1,600 in. through a lower ditch 2½ miles long; 900 ft. of pressure may be had, but only 300 ft. are made use of. There are 1,700 ft. of 13 in. pipe and one "giant" with 5 in. nozzle. The season lasts from May to September, working one shift. Besides the bedrock cut, there are 82 boxes of 6 ft. tail flume, on a 3½ in. grade to the box, paved with block riffles. Messrs. Bloss & McClary, of Trinity Center, owners.

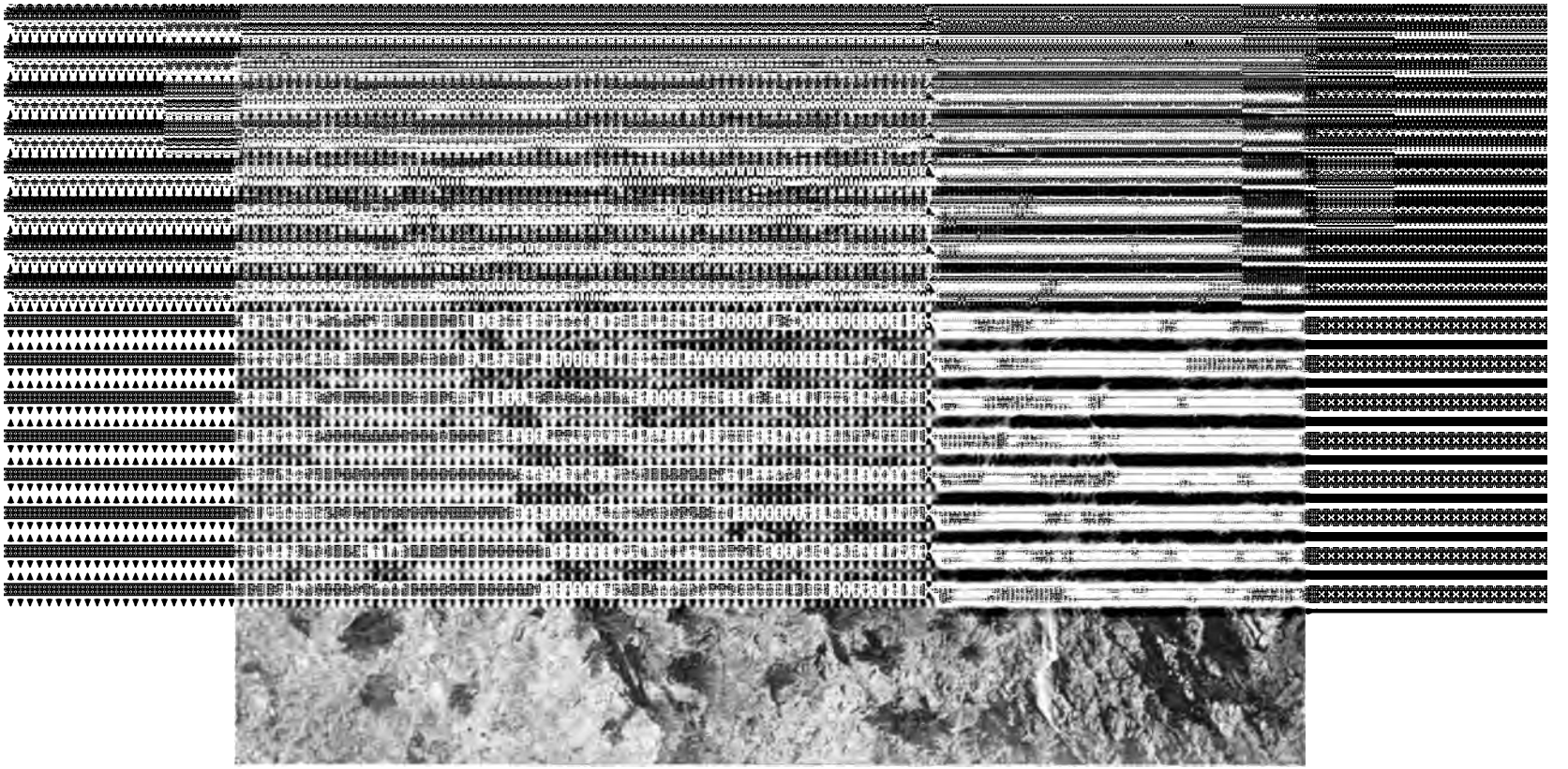
Bonanza Mine (Quartz).—This is on the west side of Bully Choop Mountain, 45 miles W. from Anderson, at an altitude of 5,200 ft., and comprises 4,500 by 600 ft. The vein, 4½ to 5 ft. wide, courses E. and W. and dips N., between a slate hanging-wall and a diabase foot-wall.

There are two tunnels, respectively 100 and 300 ft. long, and giving 50 and 100 ft. backs. The ore is of a good grade and carries 3 per cent of sulphurets. A 3½ ft. Huntington mill, half a mile from and 700 ft. lower than the mine, is run by an 8 ft. hurdy wheel under 200 ft. pressure. The ore is sledded from the mine to the mill, which has a capacity of 10 tons in twenty-four hours, and is supplied with a 10 ft. apron set on a 1¾ in. grade to the foot; also a Triumph concentrator. A furnace is in course of construction. Hart Bros., of Agland, owners.

Brown Bear Mining Company's Mines (Quartz).—See our VIIIth, Xth, and XIth Reports, pp. 639, 713, and 483. They are 9 miles W. of French Gulch, in T. 33 N., R. 8 W., and consist of the Last Chance, Monte Cristo, and Brown Bear, besides others of less importance, covering in all more than 200 acres. The two latter are on the same vein, and the former is parallel at a distance of 180 ft. The vein courses E. and W. and dips 40° N. The ore bodies vary in width from almost nothing to 10 ft., with granite on the north and slate on the south. The principal works at present are on the Last Chance and Monte Cristo. There are four working tunnels beneath one another, about 100 ft. apart, and all connected; it is the same with the Monte Cristo. The principal tunnel on the Last Chance runs on the vein 5,000 ft. in length. The mine requires heavy timbering, and what is quite a drawback the ore is handled repeatedly before it reaches the mill. There is a 15-stamp mill connected with the property, carrying 700 lb. stamps. The ore is passed over a grizzly, the bars 2 in. apart; then through a Hendy crusher into the ore-bins leading to Hendy self-feeders. The stamps are dropped 3, 1, 5, 2, 4, at the rate of 92 per minute, 5½ in. drop, with a discharge varying from 6½ to 7 in., through a No. 10 slot screen, giving a duty of 1½ tons per stamp in twenty-four hours. The mortar has front and back plates on the inside; the apron plates are 12 ft. long and 18 in. wide. Two Frue and two Triumph concentrators handle all the pulp. The concentrates are sent to chlorination works a mile below the mill. The plates are only scraped when the batteries are cleaned up, and yield 10 per cent of the amalgam, as against 90 per cent obtained from the batteries. Fifty-five men are employed. C. H. Watt, John Melton, and Mrs. H. Martin et al., of Deadwood, owners.

Bully Choop Mine (Quartz).—This is on the west side of Bully Choop Mountain, and comprises several claims. The principal vein courses E. and W. with a nearly vertical dip, and averages 1½ ft. in width, between slate and porphyry walls. Developments consist of a shaft sunk on the vein and a tunnel run to tap the shaft, besides some open cuts along the surface. One and a half miles from and 1,000 ft. below the mine is a 5-stamp mill and two arrastras, run by water power, to which the ore is hauled on small narrow-gauge wagons. The quartz is high grade, and carries about 3 per cent of sulphurets of iron and copper. Messrs. G. A. Grigsby and — Johnson, of Agland, owners.

Campagnie Française de Placers Hydrauliques (Hydraulic).—This claim is half a mile W. of Junction City, and comprises 1,300 acres. The gravel bank is part of a former bench of the drainage when on a higher level, about 200 ft. above the present river. Five such benches have been noted; on the second bench above the present river bed the most platinum is found in the gravel on cleaning up. There are two pits in operation, the height of the respective banks being 150 and 40 ft., with about 35 ft. of genuine gravel and a soil capping; the entire bank up to the grass roots is gold-bearing. Six "giants" are in use in



one pit, with 6 in. and 7 in. nozzles, and one with an 8 in. nozzle in the other; they work under 160 ft. pressure. Water is obtained through 11 miles of ditch from Cañon Creek and 2 miles of ditch from Mill Gulch. The faces of the bank are 2,200 and 1,600 ft. long, respectively; the duty of the water per day is 2 cu. yds. of dirt per miner's inch. The gravel is free, there being no clay and no big bowlders, resting on slate bedrock, and carrying cucumber-seed gold. Drifts are run and the bank blasted to increase the duty; about 900 lbs. of powder are consumed each month. The mine is run day and night during the water season of eight months; the remainder of the year is taken up with cleaning bedrock. The gravel is washed through bedrock cuts 4½ and 5 ft. wide, 900 and 300 ft. long, on an 8 in. grade, paved with blocks; besides these, 2,000 ft. of sluices are used, set on a 5 in. grade. The first 250 ft. of flume is cleaned up every fifteen full working days. Quicksilver is used in the boxes, and the gold is .915 fine. The company have their own sawmill on the ground; its blocks costing $10 per thousand feet, board measure. Telephones and electric lights are being put in place, and new water sources are to be tapped to enable the work to continue day and night the year round. There are 44 men employed at $2 50 per day, board being furnished at $20 per month. F. Heurtevant, of Junction City, manager.

Chapman & Fisher Mine (Hydraulic).—See our. Xth Report, p. 708.

Chinese Gravel Claim (Hydraulic).—It is at Trinity Center, adjoining and partly in front of the Bloss & McClary claim, and on the same channel. The bank is 150 ft. high, with about 20 ft. of partly cemented gravel next the slate bedrock. One 5 in. giant is used under a pressure of 60 ft. head. The 4 ft. flume is paved with wooden blocks, is over a mile in length, and dumps into Trinity River. The gold is cucumber-seed shaped, and worth $18 per ounce. The ground is nearly worked out. Chinese Company, owners.

Chloride Mine (Quartz).—This is 2½ miles N.E. of Dedrick, at the head of Cañon Creek, and comprises seventeen locations with four veins; the main one courses N. 7° E., dips 30° S., between syenite walls, 3 to 6 ft. apart. The present developments consist of three tunnels, one on each of the three claims: the Chloride, Big Bally, and Little Bally, all cross-cuts. The Chloride main tunnel cuts the vein at 80 ft., then turns on the vein 100 ft.; the Big Bally has 40 ft. of cross-cut tunnel and 120 ft. on course of the vein; the Little Bally has a 70 ft. cross-cut to the vein. On the Chloride they have 125 ft. of backs, which increase rapidly going into the hill. The quartz carries a good percentage of sulphurets, including galena. The Big Bally has a large proportion of iron sulphurets. The Little Bally has opened up a feeder about 3 in. wide making to the main vein, and prospecting about $60 per ton. Timber is rather scarce, though there is a plentiful supply below. A 3½ ft. Huntington mill, run by a 3 ft. Pelton wheel under 175 ft. pressure, is a mile below the mine, to which the ore is hauled on sleds, carrying 1½ tons per load, and making four trips per day. Ores under $10 do not pay to handle; freight from Dedrick P. O. is $3 per mule load. The altitude at the mine is over 5,000 ft. Miners' wages, $2 and board. The mill only runs during the day, and crushes 6 tons through a No. 40 slot screen. A peculiar arrangement of the feed passes the ore through the self-feeders before passing through the crusher, from which it is dropped immediately into the mill. Below the mill are two 10 ft. aprons, 4½ ft. wide, set on a 1½ in.

grade to the foot, but no appliances for saving the sulphurets, which are said to assay well. The plates are scraped every day and the mill cleaned up once a month. The property is leased. C. W. Smith et al., of Weaverville, owners.

Cleveland Consolidated Gold Mine (Quartz).—This is on the S.W. side of Bully Choop Mountain, at an elevation of 5,500 ft., and comprises nineteen full claims. The main vein, averaging 7 ft. in width, courses N. 15° W., between a slate hanging-wall and a diabase foot-wall, with a dip to the E., varying in its pitch, being flatter near the surface. Developments consist of a tunnel run in on the ledge a distance of 350 ft., and about 250 ft. below the croppings, connected with the mill by an incline tramway 700 ft. long. The quartz, which is mostly high grade, appears to be formed by replacements, and carries some lime. A large percentage of the gold is float gold, which presents difficulties in milling, a very large portion of the assay value going off with the slimes. The present milling method passes the ore over grizzlies set to 1½ in. openings between bars, through a Dodge rockbreaker and Hendy self-feeder. The 10 stamps weigh 750 lbs. each, and drop 93 times per minute, with a 6 in. drop and 5 in. discharge, using No. 20 slot screens. The apron is 4 by 12 ft., set on a ¾ in. grade to the foot. The pulp passes direct from the aprons onto the six Triumph concentrators. The quartz carries 6 per cent of sulphurets, mostly iron and copper; these are roasted in a 60 ft. reverberatory furnace furnished with three steps, and later amalgamated in a revolving barrel, making about 22 revolutions per minute. The pulp is discharged into a tub and washed out with a hose over silver plates and through traps. The results are fairly satisfactory and cheaper than the chlorination, which was formerly practiced. These silver plates are set on a grade of 1 in. to the foot. The principal apron plates are scraped once in twenty-four hours, and produce 80 per cent of the amalgam saved. The entire mill is cleaned up once a month. A 37 horse-power engine requires daily 5 to 8 cords of wood, costing $3 per cord. Wages are $2 25 per day; freight from the railways is 1 cent per pound. R. G. Hart, Jr., of Agland, owner.

Danbrink Claim (Hydraulic).—It is 4 miles S. from Dedrick, on Cañon Creek. — Danbrink, of Dedrick, owner.

Enterprise Mine (Quartz).—See our VIIIth Report, p. 643.

Globe Mine (Quartz).—This is 5 miles N.E. from Dedrick, at an elevation of 5,500 ft., and comprises seven claims. The veins are parallel, and course N.E. and S.W. and dip about 60°. The main vein is 3½ to 13 ft. in width, with porphyry and mica schist walls. The quartz carries several per cent of sulphurets, mostly iron. The mine is developed through tunnels, all run on the vein. No. 1, the lowest, is 80 ft.; No. 2, 128, and No. 3, 265 ft. in length, with an upraise of 126 ft. to the surface. The No. 2 is the main tunnel at present; a chute on the outside conveys the quartz to a tramway that delivers in the mill. The mine is extremely favorably situated for development through drifting, gaining 1 ft. in depth in every 3 ft. in length. The timber is all below the level of the mine and has to be packed on mules. Freight from Dedrick, by pack animals, is 1 cent per pound. Lumber costs $50 per thousand feet. A 3½ ft. Huntington mill, with an output of 5 tons per twenty-four hours, is run by a 7 horse-power engine, consuming 1 cord of wood daily. The water for the mill is obtained partly from a spring and partly from a neighboring gulch. The apron plate is 10 by 5 ft. A No. 60 steel wire

screen is used, also a self-feeder and a rockbreaker, but no concentrators. The mine is closed at present through litigation. R. Woodburn, of Dedrick, owner.

Gold Leaf and Great Eastern Mine (Quartz).—This is 10 miles W. from Castella by trail, and comprises 3,000 by 600 ft. The vein courses N.W. and dips 45° S., and has a width of 2½ to 4 ft., between porphyry walls. The quartz carries little sulphurets. The developments consist of a tunnel on the vein 125 ft. long. Wood and water are plentiful in the neighborhood of the mine. J. N. White et al., of San Francisco, owners.

Golden Chest Mining Company's Mine (Quartz).—See our VIIIth Report, p. 641.

Good Friday Placer Mine (Hydraulic).—This is 3 miles S. of Junction City, and comprises 80 acres. The mine is on a bench; the bank is from 60 to 70 ft. in height. The mine obtains its water supply from a neighboring gulch and uses a No. 1 "giant"; the water season is short. T. C. Post and T. E. Jones, of Junction City, owners.

Gribble's Placer Claim (Hydraulic).—It is 3 miles S. of Junction City, and comprises 100 acres. The work is at a standstill at present, on account of the caving away of the upper ditch. The bank is from 35 to 90 ft. in height, with 15 ft. of gravel on the second bench from present river level. It is worked through an open cut, 300 ft. long, carrying a 3 ft. flume supplied with block and cross riffles. One "giant" with a 4 in. nozzle is used. The water season lasts six months. The gold sells for $17 50 per ounce, and is fine and scaly, and associated with some platinum. Mrs. Gribble, of Junction City, owner.

Haas Mine (Hydraulic).—See our Xth Report, p. 703. It is 1 mile S.E. from Junction City, and comprises 160 acres of patented ground. The bank is 40 ft. high, with about 600 ft. face, and 16 ft. of gravel on the bedrock and a capping of loam and pipe-clay. The gravel prospects throughout in fine scaly gold, which sells at $17 75 per ounce. Two "giants" with 6 in. nozzles are used, and supplied through 3,500 ft. of 15 in. pipe. The water is furnished from Clear Gulch, a tributary of Cañon Creek, through 7 miles of ditch, carrying 1,800 in. and delivered under 370 ft. pressure. The season lasts from December to July. There are 100 flume boxes 4 by 3 ft., paved with 8 in. blocks and set on 4½ to 6 in. grade. One undercurrent, 12 by 48 ft., is filled with Hungarian riffles. The blocks cost 2 cents per foot, board measure; lumber costs $20 per thousand feet, and has to be hauled 4 miles. The bedrock is slate; the channel is a former bed of the present drainage area at a higher level. Three acres have been worked off in all. The tailings are dumped at the edge of Trinity River. F. G. Haas, of Junction City, owner.

La Grange Mining Company's Mine (Hydraulic).—This claim is on Oregon Gulch, 4 miles west of Weaverville, and comprises over 400 acres. The gravel bank worked at present has the characteristic of a glacial deposition; the pit is about 245 ft. deep, carrying gravel throughout, with the gold distributed from top to bottom; the distance across the pit is about 1,200 ft. Three "monitors" are in use, two 15 in. and one 7 in. nozzle, working under 260, 400, and 440 ft. heads. The pipe-lines contain 1,200 ft. of 15 in., 2,500 ft. of 18 in. reducing to 15 in., and 200 ft. of 22 in. reducing to 18 in. Two derricks are used, capable of lifting 4 tons, and have a reach of 90 ft. Last year 3 tons of

powder were used in blasting. The water supply is derived as follows: 3,000 in. from the Rush Creek ditch, 14½ miles long, and 1,500 in. from the West Weaver ditch, 4 miles long; the season lasts from December to September. At present 400 ft. of 6 ft. wide sluice-boxes are used, set on a grade of 1 in. to the foot, and paved partly with rock and partly with wooden blocks, costing $7 per thousand. One undercurrent, 18 by 48 ft., with three compartments, set on a grade of 13 in. to 12 ft., and paved with rocks and blocks, is used. Lumber has to be hauled 4 miles. A clean-up is made when the blocks are worn out. The debris is dumped into Oregon Gulch. At present 37 men are employed, who receive $2 50 per day. The gold is largely cucumber-seed gold, although some quartz gold is found, and sells for $19 25 per ounce. W. H. Radford, of Weaverville, Superintendent.

Last Chance Mine (Quartz).—See Brown Bear Mine.

Lewis & Keenan Claim (Hydraulic).—This is a bar on Cañon Creek, 1 mile S. from Dedrick. Lewis & Keenan, of Dedrick, owners.

Loman & Wyld Claim (Hydraulic).—This is on Indian Creek, 1 mile from its mouth and 3 miles from Douglas City; it consists of 20 acres of an old bar. The bank, which carries from 10 to 30 ft. of gravel, is just being opened; the water supply is obtained from a dam 22 ft. high, about 1 mile up Indian Creek; the ditch carries about 300 in. of water. A No. 2 giant and 450 ft. of 15 in. pipe are in use. The 3 ft. flume of 15 boxes is lined with blocks; no undercurrent. Blocks cost 1 cent per foot, board measure; lumber, which has to be hauled 15 miles, is worth $25 per thousand feet, and general freight costs 1⅛ cents per pound from railroad. The gold is .920 fine. Loman & Wyld, of Douglas City, owners.

Mahoney & Wallace Mine (Hydraulic).—It is on Cañon Creek, three fourths of a mile from Dedrick P. O. Mahoney & Wallace, of Dedrick, owners.

Maple Gold Mine (Quartz).—It is 1½ miles S.E. from Dedrick, near Cañon Creek, and consists of five claims. The vein courses N.W. and S.E., varying in width from 8 to 12 ft., between porphyritic and greenstone walls. It carries a large percentage of sulphurets, which are not saved, as the present works are for prospecting only. The ore is reduced in a 10 ft. arrastra run by water power. Developments consist of a main working tunnel cross-cutting for 90 ft., then turned 180 ft. on the vein, giving 150 ft. of backs. A second tunnel, 70 ft. above, is drifted 90 ft. Water power is obtained from the East Fork of Cañon Creek, through a ditch 1⅛ miles long, giving 80 ft. pressure. D. L. Smith, of Dedrick, owner.

Mary Jane Gold Mine (Quartz).—This is 2½ miles N.E. from Dedrick, and comprises two full claims. The vein courses N.E., dips 70° E., and is 2 to 8 in. wide, between a mica schist hanging-wall and a porphyry foot-wall. The mine is just being opened by a tunnel, at present 30 ft. long. Ralston & Spenser, of Weaverville, owners.

McMurray & Hupp Gravel Mine (Hydraulic).—See our Xth Report, p. 701. This is in Sec. 7, T. 33 N., R. 9 W., half a mile below Weaverville, and comprises 96 acres of patented land. The gravel deposit is 40 ft. deep. McMurray & Hupp, of Weaverville, owners.

Minersville Placer Mining Company's Mine (Drift).—This is 1½ miles E. from Minersville, and comprises 160 acres. The company is drifting for a channel supposed to run N. and S. They have penetrated slate

bedrock 180 ft., and expect to strike the channel in 40 ft. more. J. C. Bolton et al., of Minersville, owners.

Monte Cristo Mine (Quartz).—See Brown Bear Mine.

North Star Mine (Quartz).—See our VIIIth Report, p. 642.

Oro Grande Mine (Quartz).—It is in Hostetter Gulch, 6½ miles N.E. from Trinity Center, and comprises six claims. The vein courses S.E., dips about 72° N.E., on a contact of serpentine with slate; the vein averages 3 ft. in width. The mine developments consist of three tunnels; No. 1, 125 ft. long and 200 ft. above No. 2, which is 350 ft. long and 147 ft. above No. 3, and this 140 ft. long; the two latter are connected by an upraise. Three quarters of a mile below the mine, at the foot of a steep hill, is the 5-stamp mill, run by an improved Leffel 13 in. turbine, supplied with water from Trinity River, under 27 ft. pressure. The stamps drop 85 times per minute, 5½ in. drop, 7 in. discharge, through a No. 8 slot screen, and have a duty of 1½ tons per stamp per twenty-four hours. The apron is 10 ft. long on 1¾ in. grade to the foot. Cost of mining is $1 per ton, hauling on sleds 75 cents per ton, and milling $1 25 per ton. Cost of lumber, $18 per thousand feet. The mine can produce 50 tons per day with 25 men. Stroude Bros., of Trinity Center, owners.

Paulsen Gravel Mine (Hydraulic).—This is on Trinity River, 6 miles W. of Deadwood, and comprises over 600 acres. This is a new undertaking, engaged at present in bringing in water from Grass Valley Creek. One of the bodies of gravel is over 400 ft. deep, and it has a dump of 400 ft. to the Trinity River. The other bodies carry from 7 to 12 ft. of gravel. P. M. Paulsen, of Weaverville, owner.

Red Hill Mine (Hydraulic).—See our Xth Report, p. 706.

Sheridan Placer Mine (Hydraulic).—This is on Trinity River, 2 miles S. of Junction City, and comprises 104 acres of patented ground on a former bar of the river. The gravel bank, with soil capping, is from 15 to 20 ft. high, with 600 ft. face. The pit is being worked through 500 ft. of bedrock flume, with 4 in. grade to 12 ft., dumping onto a bar of Trinity River. The water supply is obtained from Simpson's Gulch through two ditches, each half a mile long, carrying 600 and 150 in. respectively, delivering it into a reservoir, which is intermittently emptied. Seven acres have been worked off with a No. 1 giant, using a 3 in. nozzle under a 200 ft. head and 1,600 ft. of pipe, reducing from 11 in. to 7 in. Season lasts six months. Sheridan Bros., of Junction City, owners.

Silver Gray Mine (Quartz).—It is 2½ miles E. from Dedrick, and comprises five claims. The vein is 8 in. to 6 ft. wide, courses N.E. and dips 75° S., between syenite walls. The developments consist of cross-cut tunnel No. 1, 60 ft. long and turned 80 ft. on the ledge, which shows an average width of 2 ft.; 400 ft. west is tunnel No. 2, which it cross-cuts 70 ft. and turns both ways on the vein 144 ft., and is 140 ft. below No. 1. Tunnel No. 5, 50 ft. lower than No. 2, is just being opened on a new ledge, from 1 to 3 ft. wide. A 5 ft. Huntington mill, running night and day, crushes 12 tons; the quartz carries 1½ per cent of sulphurets of a fair grade. The mine has lately changed hands.

Swift & Co.'s Claim (Hydraulic).—It is 4 miles N.E. of Douglas City, and comprises 80 acres. The bank, which is a part of the former river bed, is from 30 to 70 ft. high and is worked with a "giant" and 450 in. of water from Weaver Creek. Thirty 4 ft. flume boxes are used, set on

grades varying from 3 to 6 in., which are cleaned up three times during the season. The gold is .875 fine. Swift et al., of Douglas City, owners.

Trinity Gold Mining Company (Hydraulic).—See our VIIth Report, p. 638.

Trinity River Hydraulic Mining Company's Claim (Hydraulic).—This is on the Trinity River, 3½ miles N.W. from Douglas City, and comprises 360 acres. The gravel deposit is the former bench and bed of the river, showing a bank 100 ft. high and 300 ft. wide, with 20 ft. of gravel; the exact width of the deposit is not known, as the work has been mostly confined to a bench. In the main part of the channel the gold is evenly distributed throughout, while on the bench it is best next to the bedrock. Two "giants" are used under a 175 ft. head, supplied with 500 in. of water through 500 ft. of 15 in. iron pipe. Reading Creek furnishes the water, and the season lasts eight months. The property is worked through bedrock cuts, with several sections of 3 by 3 ft. flume, having a total length of 480 ft., set on a 9 in. grade to the box, and paved with wooden blocks. One undercurrent is used, 14 ft. wide by 30 ft. long, set on a grade of 1 in. to one foot, and paved with small blocks. The tailings dump on a bar of Trinity River. The gold is of the cucumber-seed kind, and has a fineness of .930; wages $2 per day and board. A. S. Dunbar, of Douglas City, Superintendent.

Trinity River Tunnel and Mining Company (Hydraulic).—See our Xth Report, p. 709.

Union Hill Claim (Hydraulic).—This is one fourth of a mile N.E. of Douglas City, and comprises 230 acres. The property is opened through 800 ft. of tunnel to the river. The bank is 30 to 90 ft. in height, and has a clay and soil capping; animal remains (bone and teeth) have been found in the gravel. There are 400 ft. of ditch, and water is delivered under 80 ft. pressure. Gold, .900 fine. Mason & Thayer, of Douglas City, owners.

Yellowstone Mine (Quartz).—See our Xth Report, p. 711. This is at Coleridge, on the East Fork of the North Fork of Trinity River, and comprises eight claims. The main veins are *North Star* and *Yellowstone*. The former is 4 ft. wide, and courses N. and S., and dips about 45° W., between granite and greenstone walls. Developments on the Yellowstone consist of a cross-cut tunnel 400 ft. long, turned south on the vein 200 ft., with an upraise to the surface. In an intermediate tunnel from the upraise, a 3 ft. ledge of ore is now being opened. There is a 10-stamp mill on the property, run by a 4 ft. Pelton wheel under 85 ft. pressure. The stamps, which weigh 850 lbs. each, drop 6 in. 90 times per minute, having a 9 to 10 in. discharge through a No. 10 slot screen. The mortar is provided on the inside with front and back plates and an outside apron plate 5 by 10 ft., set to a grade of 1½ in. to the foot. The sluice plates are 16 ft. long and 24 in. wide, on the same grade as the apron plate. The tailings are said to assay 73 cents per ton. Yellowstone Mining Company, owners; W. T. St. Aubyn, of French Gulch, Superintendent.

VENTURA COUNTY.

Bunker Hill Mine (Quartz).—It is on the western slope of Frazer Mountain. It is developed by tunnels and open cuts, exposing a large ledge of disintegrated quartz. The vein has a N.W. course. It has associated with it a narrow stratum of mica schist, that and the vein

being inclosed between dikes of a beautiful augen gneiss. Gold is found not only in the quartz but in the crushed portions of the walls. Haylock Bros., of Ventura, owners.

Castac Mine (Quartz).—It is on Piru River, in the Snowy District, about 10 miles S. of Gorman Station. The veins have a N.W. course, dipping to the N.E. The country rock is quite varied, though everywhere more or less schistose. It is clearly exposed in the walls of the cañon opposite the mill, where it seems to vary from a hornblende schist to a syenite gneiss with a knotty appearance. The main tunnel has an elevation of 600 ft. above the river, and so precipitous is the cañon that a cable has been stretched from the dumps down to the mill on the opposite side of the creek. Down this cable the ore is lowered as fast as it can be crushed. There are 3,000 ft. of tunnels and upraises. The vein varies greatly in size, but averages 3½ ft. It is partly free milling and partly sulphuret ore. See our VIIIth Report, p. 683. A. Fraser, of Gorman Station, owner.

Fairview Mine (Quartz).—It is on a vein inclosed in augen gneiss, and adjoins the Bunker Hill. Two tunnels have been run; the upper one 290 ft. and the lower 130 ft. long. In addition to gold, there is found silver-bearing galena in a dolomitic matrix. The galena is sometimes found in large masses. The gold occurs both free and associated with sulphurets. The ledge matter is cut by a network of brown iron veinlets. A mill is soon to be erected. Haylock Bros., of Ventura, owners.

Frazer Mine (Quartz).—This is on the steep southern slope of Frazer Mountain, a few hundred feet below the summit. It is the most easterly of the deposits on the mountain. The veins have a N.W. course, conforming to the schistose structure of the country. The rock varies from a hornblende schist to a syenite gneiss, the latter often showing the peculiar character of augen gneiss. The veins are contained in a zone 200 ft. wide, in which the rock is greatly crushed. All the quartz carries gold, and though the workings have not been systematically developed, there are in sight large bodies of ore. The mine has been worked for many years, and is reported to have produced a large amount of gold. See our VIIIth Report, p. 682. E. P. Chilsen, of Gorman Station, Superintendent.

Montecito Gravel and Quartz Company (Placer).—The deposits of gravel on which this company is at work extends along the north side of Piru River, from about 2½ miles above the mouth of Lockwood Creek to its head, and also in San Quelmo Cañon, a tributary of Lockwood Creek. The average width is said to be 3 miles. Sluicing and rocking have been carried on intermittently here for many years. The gold is coarse and not much worn. The gravels lie in the form of terraces, extending in places to the top of the hills between Piru River and Lockwood Creek. They were probably deposited by a Pliocene river heading more toward Mount Pinos than the present Piru. Underneath the gold-bearing gravels is an older deposit of a different character, and barren of gold. It is more firmly cemented and perhaps belongs to the Miocene, which is so strongly developed in this section. In a similar manner, gravels overlie the Tertiary on the flanks of Frazer Mountain and Mount Pinos. On the former mountain they are gold-bearing. The great trouble heretofore has been the lack of water for sluicing. Water is present in sufficient quantities in the Piru, but will have to be brought a number

of miles in order to get the requisite fall. Judge Roberts, of Goleta. President.

White Mule Mine (Quartz).—It is on the western slope of Frazer Mountain, a little distance below the Fairview. Here are found three veins dipping to the north. They are separated by dikes of augen gneiss, but in immediate contact with each is a stratum of mica schist. The gold is mostly contained in iron sulphurets, which, in places, form a large part of the vein. A Huntington mill has recently been erected. but the work soon stopped when it was found that the mill was not adapted to the character of the ore, and that very little gold could be saved. See our VIIIth Report, p. 682.

YOLO COUNTY.

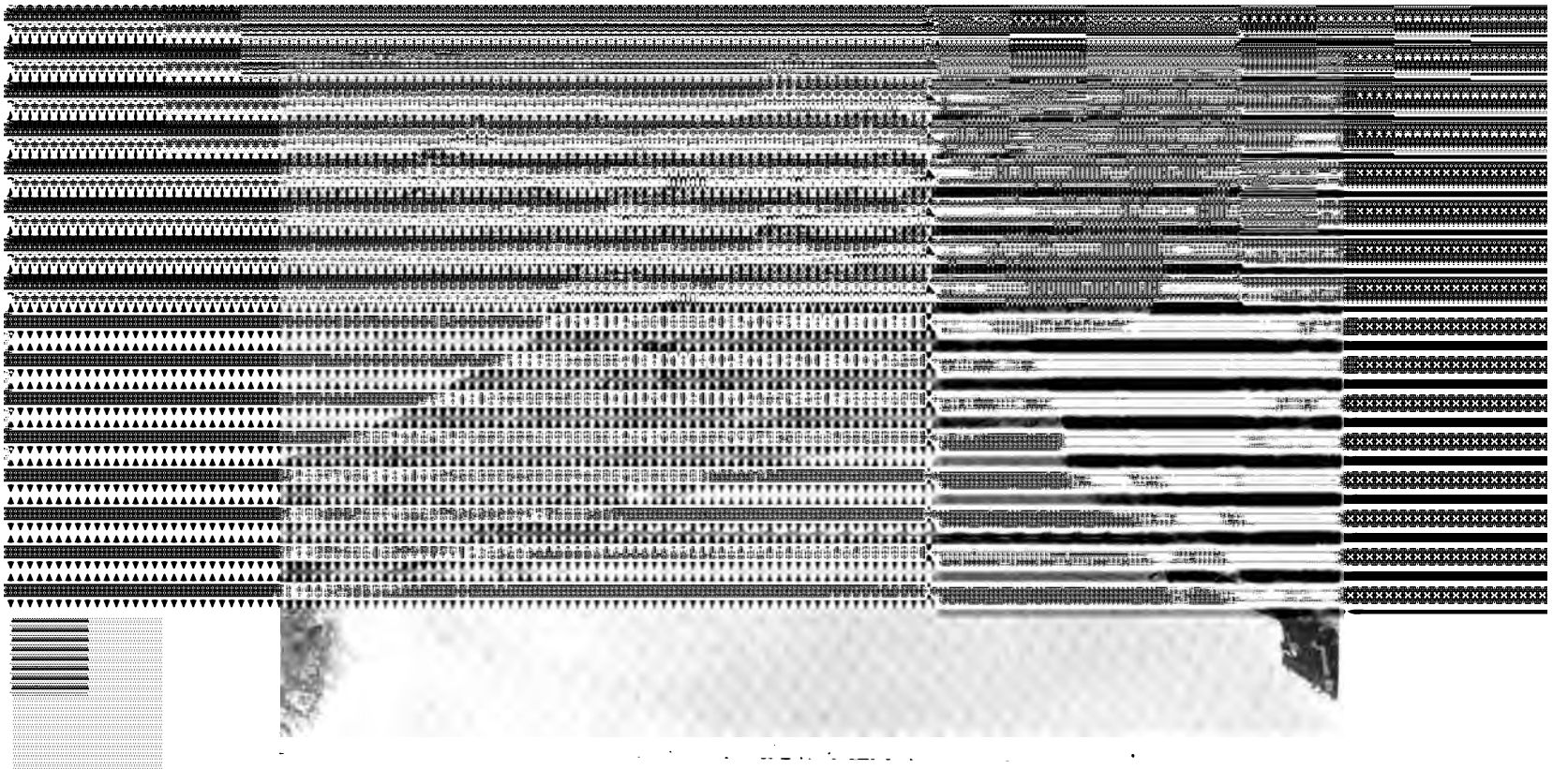
As is well known, Yolo County occupies one of the most fertile portions of the Sacramento Valley, and the greater part of its area is well adapted to the growth of either grain or fruit. It is nearly all valley land, along the western borders of which there is a fringe of mountains belonging to the Coast Range.

Yolo County is well watered by streams, besides having an abundant supply of subterranean water, which is reached at no great depth. See our Xth Report, p. 773, *et seq*. At present the only permanent mineral industries of the county are brick-making, near Woodland, and the quarrying of building-stone at the Devil's Gate, in Putah Cañon. See our Xth Report, p. 791.

Cache Creek (Placer).—Last winter two men were employed for a few weeks in mining on land of F. Scharden. It is said that they made laborer's wages and obtained fine flake gold.

YUBA COUNTY.

The entire eastern side of this county presents features extremely favorable to the quartz-mining industry, although little is being done in that direction. We find that at one time several extensive mining operations were carried on around Brown's Valley, and that this district has a record of having produced and shipped at least $6,000,000, although the deepest working was only 700 ft. beneath the surface. Expensive management, water in mines, and litigation caused the suspension of operations in this once lively camp. From this point N. and E. to the county boundary is a section of country that would well repay an intelligent prospector for his labors; the great drawback being that so much of the land has passed to private ownership through agricultural patents. The entire surface of this section is more or less gold-bearing and ribbed with large quartz veins, which, though largely of a low grade in gold, carry paying shoots, as has been proved in several instances; moreover, numerous seams of quartz make from both sides to these larger quartz bodies, and these are frequently heavy gold-bearers. The formations through this portion of the country are as favorable as any to be found through the mineral belt of California; we find diorites, diabase, metamorphic slates, serpentines, etc. Over large areas of this section at an early day the labors of the placer miner were well repaid, but quartz mining being then in its infancy, the sources of the gold were neglected in the search for the more easily worked placers.



Under the conditions prevailing at present in the mining world, this section should be taken hold of and made to yield its stores of the precious metal. Wood, water, and transportation present no difficulties, and the fruitfulness of the county secures cheap living.

Beehive (*Mount Hope*) *Mine* (Quartz).—This is 4 miles E. of Forbestown, in Sec. 8, T. 19 N., R. 7 E. The property comprises 20 acres of mining land and 160 acres of timber land, which is patented. The course of the vein is N. 8° 30′ E., and dip 45° E.; the vein averages 4 ft. in width, between a slate hanging-wall and a granite foot-wall. The quartz is of ribbon structure, carrying about 3 per cent of sulphurets, being galena, very large cubical iron sulphides, and fine-grained ones. The mine was worked in former days to a depth of 50 ft. on the vein, and the ground stoped to the surface on a continuous ore shoot of 400 ft. in length. The present owners have sunk on a 30° pitch an incline 70 ft. on the vein, stoping out what was left of the old ground, and are sinking the shaft to connect with an old tunnel which drains the mine. The ore is crushed in an 8-stamp steam mill, with 750 lb. stamps. The ore is passed over grizzly bars 1¼ in. apart, then through a Blake crusher to the batteries, old style self-feeders being used, worked by jarring. The stamps drop 96 times per minute, with a 6 in. drop, and about the same discharge at starting; perforated No. 2 tin screens are used, and 2 tons per stamp are crushed daily. Below the mortar is a 4 by 12 ft. apron set on a 1 in. grade to the foot; this narrows down to 1 ft. wide and joins a sluice plate for each battery, 10 ft. long and 1 ft. wide. From the sluice plates the pulp is passed over 35 ft. of blanket sluice, which is washed every hour; it then reaches a riffled sluice, where the riffle is gradually built up by adding inch strips; this box has a grade of 1 in. to the foot. A canvas plant, of seven sections 22 in. wide, with a grade of 1 in. to the foot and 50 ft. long, then receives the pulp, and it finally reaches the slime tanks, 16 ft. long and 12 in. square, set level, with overflow on the upper edge. Some difficulty has been experienced in milling this ore, and the operation is still in the experimental stage. A partial cause of this difficulty is attributable to a large amount of mica carried by the quartz in the upper part of the vein. The machinery is run by steam power, the same set of boilers in the mill building supplying power for both mill and hoist; a 50 horse-power engine runs the mill. Freight from the railroad is 75 cents per 100 lbs. Under the present conditions of milling, cleaning the plates every two or three days and the battery once a month and having no plates inside of the mortar, the proportion of gold saved in the latter is less than on the plates; the gold is worth about $16 per ounce. Messrs. H. J. Bacon and W. G. Scott, of Forbestown, owners.

Blue Points Gravel Mine (Placer).—This is one fourth of a mile E. of Smartsville, adjoining the Excelsior. It has been worked as a drift mine, but the bank caving has closed the entrance, and as hydraulicking is not permitted, the caved mass is being ground-sluiced off. The company obtain their water supply, about 900 in. through 28 miles of ditch, from Wolf Creek. The channel is 2,000 ft. wide, coursing N.W. and S.E., with the north rim very steep. About 25 acres have been worked. Sixty feet of gravel next to the bedrock is cemented, and this has to be worked through an arrastra, after passing through a Gates crusher; the remaining 150 ft. of the bank is freer. The gold is fine and scaly. At

present the company uses 30 sluice-boxes, 4 by 3½ ft., with rock riffles. P. Campbell, of Smartsville, owner.

Brandy Creek Mine (Placer).—This is 2½ miles N.W. from Camptonville, and comprises 6,500 by 600 ft. The course of Brandy Creek at this point is N.W. to S.E.; the width of the channel is about 300 ft. This is largely a tailings claim, with occasional patches of virgin gravel on the slate bedrock. The depth of the bank is about 5 ft., while where the gravel is still in place it averages about 1½ ft. in depth. The gravel is free and does not carry many large bowlders. The gold is scaly, with some shot gold, and sells for $18 per ounce. The water season is usually from four to five months. About 300 ft. of the channel has been worked during the past season; about 1½ ft. of the bedrock is picked up. In washing, no boxes are used; there is about 700 ft. of bedrock cut and ground-sluice, in which quicksilver is used, and which is only cleaned up at the end of the season. Messrs. Stevens and others, of Camptonville, owners.

Chandler Gold Mine (Quartz).—It is situated 2 miles S. of Brown's Valley P. O., and contains 160 acres of patented ground. The vein courses N. and S., and dips about 45° E., and is 4 in. wide. This is a pocket ledge, as far as proved. J. Lafferty, of Brown's Valley, owner.

Dakota Mine (Quartz).—This claim, 1,500 by 600 ft., is 1½ miles N.W. from Brownsville, and is at an elevation of 2,600 feet above sea-level, on a vein running N. 30° W. and dipping 15° E. It is about 3 ft. wide, between rotten slate walls, and carries a very small percentage of iron and copper sulphides. An incline 4 by 5 ft., and timbered throughout, is down 30 ft.; 200 ft. farther to the south, and about 90 ft. lower on the ledge, is a second incline on a 45° pitch on the vein. By digging 2½ miles of ditch, a good water power can be had from the Gordon ditch. Timber is abundant on the ground; freight costs 40 cents per hundred from the Honcut railroad station. Messrs. J. C. Campbell and T. A. Hawley, of Brownsville, owners.

Dannebrog Mine (Quartz).—It is in Sec. 16, T. 16 N., R. 5 E., in Brown's Valley, and is a patented claim of 1,500 by 400 ft. The vein courses N. 35° W., in diabase, with a width varying from 2 to 6 ft.; it carries about 3 per cent of sulphurets. Developments consist of an incline on the vein 600 ft. in depth, with six levels, turned every 100 ft. to the east; the maximum extent of the drifting is 300 ft. Three shoots are known, averaging about 140 ft. in length. See our Xth Report, p. 798. — Rideout, of Marysville, and — Burris, of Brown's Valley, owners.

Delaware Mine (Quartz).—It is in the immediate vicinity of Indiana Ranch, 6 miles S.E. from Brownsville, and comprises 3,000 by 600 ft. The property is a north extension of the Eagle Mine, the vein coursing N. 28° E., nearly vertical, with decomposed rotten walls; the vein in the upper portion being much decomposed. A shaft has been sunk on the vein 30 ft., and shows 3 ft. of quartz in the bottom, with bunches of iron and copper sulphurets, also free gold of a rusty nature. A tunnel is being run on the vein, which will reach about 5 ft. below the bottom of the shaft, with a length of about 80 ft. The ground has to be timbered throughout on account of slips. No reduction works are here at present, but an arrastra is to be built; water can be had for power from Keystone Creek. Enoch Bros., of Dobbins' Ranch, owners.

Eagle Gold Mine (Quartz).—This is near the Indiana Ranch, 6 miles S.E. from Brownsville. The claim consists of 750 by 600 ft. on a large

quartz vein coursing N.E. and S.W., with a slight dip to the S.E. The walls of the vein are entirely decomposed where exposed, forming practically a clay; the country rock is slate and dioritic granite. The old works, consisting of a long tunnel along the vein, is caved in, and the owners at present confine their work to the outcrop. A 5-stamp mill with a portable steam engine stands exposed to the weather. The ore carries some sulphurets, mostly iron. L. Wilder and J. Rodgers, of Dobbins' Ranch, owners.

Excelsior Water and Mining Company (Hydraulic).—This claim is situated about one fourth of a mile E. of Smartsville, and extends to Mooney's Flat, with the exception of the Blue Points claim. Under the present conditions governing the workings of such mines, only about 10 acres next to Smartsville can be hydraulicked. A restraining pool for this amount of ground is provided in the old pit and reservoirs from there down to Timbuctoo. The upper settling pool in the former pit has a depth of 75 ft. and a total capacity of 4,000,000 cu. ft. The gravel bank is 150 ft. in height, resting on a cement bottom, on a hard bedrock. Next to the cement on the rim large bowlders are met, but most of the bank consists of smaller wash. Very little pipe-clay is met, and in only one part of the bank is there any lava capping. The bank is attacked with short drifts, requiring about 200 kegs of black powder per month; besides this from 6 to 8 boxes of Hercules powder are used per month for blasting bowlders. Two "giants" with 5½ in. nozzles are used; the water, 1,200 in., is delivered through 1,200 ft. of 22 in. and 15 in. pipe, under 200 ft. pressure. The water supply is owned by the company, and is obtained from the South Yuba; a further supply of 1,000 in. is taken from Squirrel Creek.

About 60,000 cu. yds. of gravel are moved per month, which passes through 600 ft. of ground-sluice and 768 ft. of flume, 4 by 3 ft., set on a 5 in. grade, and lined partly with rock riffles and partly with 3 by 4 in. slats. The boxes and the three undercurrents, 6 ft. wide, are supplied with quicksilver. The boxes are cleaned up every two months. The tailings and water pass into the settling pool of the old pit, thence into another pool in the neighborhood of Timbuctoo, and thence down the cañon to the river. The gold is fine and scaly; the largest piece found not exceeding the size of a pea; its fineness is .950. Lewis Conrad, of Smartsville, Superintendent.

Golden Gate Mine (Quartz).—This claim, 1,500 by 600 ft., is 4 miles E. of Forbestown. The vein runs E. of N., parallel with the Beehive, and dips E.; the walls are slate and granite, 2½ ft. apart. Two tunnels have been run for prospecting. S. N. & T. B. Thurston, of Forbestown, owners.

Golden Mary Mine (Quartz).—This claim, 1,500 by 600 ft., is 1 mile S.W. of Brownsville, in Sec. 34, T. 19 N., R. 6 E. The vein varies from 3 to 6 ft. wide, courses a little E. of N., and dips 57° W.; the walls are soft and decomposed as far as the work has proceeded. The country rock is partly slate and partly a dioritic granite. The quartz is white, milky, somewhat brittle, and with ribbon structure, and carries a small percentage of iron and copper sulphides; free gold is also visible at times. There are several heavy quartz outcrops lying parallel, and apparently all dipping to the west. It is on the most westerly of these that the prospect work is being done, which consists of an incline shaft 4½ by 8 ft., sunk to a depth of 28 ft. on the vein, showing a 6 ft. vein in the bottom;

the ore shoots, as far as can be ascertained, pitch to the north. About 100 ft. from the shaft is a 10 ft. arrastra, run by a 16 ft. overshot wheel, requiring 40 in. of water, which is taken from the Forbestown ditch at a cost of 10 cents per inch. Timber can be had for the cutting; lagging costs 3 cents apiece. Freight is brought from Honcut at 40 cents per hundred. H. L. Clark and T. Cobain, of Brownsville, owners.

Good Hope Gold Mine (Quartz).—This claim, 3,000 by 600 ft., is three fourths of a mile from Cabbage Patch, 10 miles E. of Wheatland. The vein, which is only a few inches wide on the surface, courses N.W. and S.E., dips about 70° S.W., and is inclosed between diorite and slate walls. The quartz carries both free gold and 4¾ per cent iron, copper, and zinc sulphurets. The developments consist of a shaft (4 by 6 ft.) sunk on the vein 190 ft., and a drift 90 ft. long. In the bottom the vein is 16 in. wide, and 70 ft. of an ore shoot has been cut, pitching S.E.; the end of the shoot has not yet been reached. The ore is hauled 3,000 ft. to a 4-stamp steam mill at a cost of 25 cents per ton. The mine requires but little timbering, and up to date no artificial ventilation. The timbers are obtained on the ground for the cutting. The 4-stamp mill has 300 lb. stamps and an apron 6 by 12½ ft., but no concentrators. If the contemplated extension of the South Yuba ditch is carried out, over 100 ft. of water pressure can be obtained at the mine. The hoisting is done at present by horse-whim. R. Vincent et al., of Grass Valley, owners.

Hibbert & Burris Mine (Quartz).—This claim, 1,500 by 600 ft., is one fourth of a mile N.W. from Brown's Valley, in Sec. 16, T. 16 N., R. 5 E. The vein courses E. and W., dips about 40° N., and has a width from 6 in. to 4 ft., inclosed in diorite, with a good gouge. Developments consist of an incline shaft on the vein 170 ft. deep, and two levels turned west 180 ft., at 90 ft. and 140 ft. A block of ground about 100 ft. in length has been stoped to the surface. Two ore shoots are known; one has been cut and the tunnel is being driven ahead to cut the second about 250 ft. distant; these shoots trend to the east. Very little timbering is required in the mine, and a 4 in. pump, running twelve hours, holds the water. The ore carries 12½ per cent of iron and copper sulphides. A 5-stamp steam mill, 800 lb. stamps, reduces the ore, making 90 drops per minute, using iron shoes and dies, and giving a duty of 2 tons per stamp in twenty-four hours; the mill runs only on the day shift; rock-breaking and feeding are done by hand. The mortar is supplied with front and back inside plates; No. 40 brass wire screens are used, and the stamps have a 6 in. drop and discharge. The water is partly supplied on the outside; the lip of the mortar is covered with plate; the apron is 6 ft. long and set on a grade of 1 in. to the foot; below the aprons, following the drop-box, are two parallel sluice plates 6 ft. long by 20 in. wide; from these the pulp passes over four sections of canvas table; but few sulphurets are saved. The power is derived from a 20 horse-power engine, with a 36 in. by 12 ft. boiler. The pump is a 4 in. jackhead. It requires one cord of wood per shift to run the machinery, costing $3 per cord. Timbers cost from 2 to 7 cents per running foot, and lagging 5 cents apiece. The bullion yield is 50 per cent from battery; the balance from plates, which are scraped every day; the battery is cleaned up twice a month. Gold is .763 fine. Wages are $2 50 for miners and $3 for mill men. See our Xth Report, p. 789. Messrs. Hibbert & Burris, of Brown's Valley, owners.

Honeycomb Gold Mine (Quartz).—This is 1¾ miles W. from Camptonville, on the west side of Willow Creek, and contains twelve claims. There are five veins in the property, running nearly parallel, with some cross-veins, the general course being N. 50° E., with a dip of 80° S.W. Some of the veins are in slate, others in granite, and vary in width from one foot upward. Several tunnels have been run and a little stoping done near the surface, showing the ore to carry considerable limonite. That known as the Honeycomb vein proper has a strike of N. 25° W., in granite rock, with a width of fissure of 4 ft. on the surface, while in the bottom of a 90 ft. shaft it shows only 8 in. of quartz. A deep tunnel, 500 ft. below the croppings, is being run to cut these veins, and is now 200 ft. long; it is being carried near the contact of the slate and granite. H. Malloch, of Marysville, Secretary.

Jefferson Gold Mine (Quartz).—This is immediately south of Brown's Valley; it is owned by an incorporated company, claiming 1,500 by 400 ft. The vein courses N. 10° W., dips 45° E., and has a width of 13 to 18 ft., in diabase and slate casings. The ore shoot is 300 ft. long, pitching 35° N. The mine has been opened by an incline 800 ft. deep, with a drift running N. 300 ft.; in the bottom there is a 13 ft. ledge. G. Harney, of Marysville, Secretary.

Johnson Gold Mine (Quartz).—This claim, 1,000 by 600 ft., is 3 miles W. of Brownsville, in Sec. 28, T. 19 N., R. 6 E. The vein courses E. and W. and dips 45° N. The country rock is slate and diorite; the vein is about 6 ft. wide, and carries about 2 per cent of sulphurets. An incline shaft has been sunk on the vein 80 ft., and a drift run to the E. about 75 ft. and W. about 20 ft.; some stoping has been done near the surface. A 5-stamp mill, as well as the hoist and a pump, are run by Pelton wheels under 130 ft. pressure; the water, 60 in., is furnished from the Forbestown ditch for $4 per day. The stamps weigh 750 lbs. each. Beyond the mill is a canvas plant, but no concentrators. H. A. Conwell, of Brownsville, owner.

Mosquito Mine (Placer).—This is on Indiana Ranch, 6 miles S.E. from Brownsville, and comprises 80 acres. The bank is about 6 ft. deep, with 4 ft. of soil capping; the bedrock is decomposed. A bedrock cut, 60 ft. long, is used for saving the gold; no boxes are used. The water is brought from Red River to the mine through one fourth of a mile of ditch and 700 ft. of 6 in. pipe; the water season lasts six months. The gravel carries coarse gold, and most of it on and near the bedrock. The clean-up is made at the end of the season. The gold sells for $18 25 per ounce. C. E. Morey, of Dobbins' Ranch, owner.

Mount Hope Mine (Quartz).—See Beehive Mine.

Old Pittsburg Claim (Drift).—This is 7 miles N.W. of Camptonville, and comprises 18 acres of ground on a channel that has been worked on both sides of the present claim, though never completely bottomed. The course of the channel is E. and W., with a width of 300 ft.; the old works extended for about 400 ft. on the channel. The gravel is dark and carries about 60 per cent of cobbles and bowlders, on a granite bedrock; it is picking ground and carries coarse gold, selling for $18 50 per ounce. A bedrock tunnel 370 ft. long has been run N. 15° W. from the cañon. A car, carrying 1,500 lbs., is used, but no gravel has been breasted out yet. The water, 50 in., is obtained from a branch of Lost Creek, and conveyed through three fourths of a mile of ditch, being delivered at the mouth of the tunnel under a pressure of 50 ft. Thirty

boxes are used on an 8 in. grade; these are supplied with Hungarian riffles. The company obtain their timber on the ground, their lagging costing 3 cents apiece. This channel is lava capped, carrying about 7 ft. of pay gravel, the 6 in. next the bedrock being the richest part. F. W. Haley et al., of Camptonville, owners.

Rattlesnake Gold Mine (Quartz).—This is one mile N. of Brown's Valley. The vein courses E. and W., dipping 40° N., in diorite; it is 18 in. wide. Cabalier & Co., of Brown's Valley, owners.

R. C. Mine (Quartz).—This claim, 1,500 by 600 ft., is one fourth of a mile E. of Brownsville. The vein, 18 in. to 4 ft. wide, courses N. and S., dips 45° E., and has walls of chloritic slate and diorite. The mine is being worked at present through two tunnels 100 ft. apart perpendicularly, and are 700 and 800 ft. long. The lower tunnel, which starts near the level of Dry Creek, is connected with an incline raised out near the mill. Through this the ore will be hoisted to the mill, while the water is run out from the tunnel. The 10-stamp mill is run by a Pelton wheel on the creek; the power being transmitted 750 ft. by wire rope. The mill contains a Dodge rockbreaker, grizzlies, Hendy self-feeders, two Frue and one Woodbury concentrator, and a small canvas plant. Reub. Clark, of Monticello, owner.

Slag Gold Mine (Quartz).—It is three fourths of a mile N. of Brown's Valley, and contains 1,500 by 400 ft. The vein courses N. and S., dips 50° W., and has an 8 in. vein in diorite. It was opened by a 200 ft. shaft sunk on the vein. Thomas Gotman, of Brown's Valley, owner.

Sweet Vengeance Gold Mine (Quartz).—It is 1½ miles N. of Brown's Valley, and claims by patent 3,000 by 400 ft. It is owned by an incorporated French company, having an office in San Francisco. The vein courses N. and S., dips E., between walls of diorite, about 3 ft. apart.

Templar No. 3 Mine (Quartz).—This claim, 1,500 by 600 ft., is half a mile E. of Indiana Ranch. The vein courses N.E. and S.W., and dips about 12° E., in a granitic formation, showing an average width of 2 ft. The sulphurets have been saved, but not worked. The vein has been worked through a cross-cut tunnel about 50 ft. below the surface; the block from tunnel to surface having been stoped out. The drift is timbered throughout. The steam-power mill has two 800 lb. stamps. No. 40 punched screens, and plates 2 by 14 ft., leading to two Frue concentrators. The tailings have all been restrained, but never worked. Cordwood costs $1 50; the mill uses 3 cords per day. Joe Merriam, of Dobbins' Ranch, owner.

York Mining Company (Hydraulic).—This is on New York House Flat, 1½ miles W. of Challenge. It contains 190 acres; 50 acres on the flat, of which from 6 to 8 acres have been worked. The bank, which is 15 ft. deep, has 6 in. of gravel on the soft granite bedrock, covered by 3 ft. of clay, the remainder being soil capping. The course of the gravel is N. and S., with a grade of 4 in. to the rod. The flume is half a mile long, lined with block riffles. The water season lasts three months, using the natural drainage from the surrounding country, which is brought through 700 ft. of 7 in. pipe under 60 ft. pressure, and discharged through a 2 in. nozzle. Lumber is worth $12 50 per thousand feet. Wages are $2 50 per day. The mine is worked by the owners. H. A. Conwell, J. W. Albert, and James Elliott, of Brownsville, owners.

GYPSUM.

It has been ably demonstrated by Prof. E. W. Hilgard, of the University of California, that this mineral is indispensable in reclaiming lands which are rendered unproductive by the presence of sodium carbonate, which is the most deleterious constituent of "black alkali." Fortunately, there is an abundance of gypsum in the Coast Range.

FRESNO COUNTY.

Coalinga Mine.—This is owned by the Coalinga Gypsum and Fertilizing Company, of Fresno, D. A. Overal, Secretary, and is situated about 9 miles N. of Coalinga, at which village a mill for grinding the gypsum has been erected. The workings at this mine consist of two open cuts. At one of these cuts the stratum mined is about 10 ft. in thickness. At the other open cut, which is probably 100 yds. south of and 25 ft. below the cut already described, there are two distinct strata, from which gypsum is obtained. It is said that about 500 tons of material have been taken from these mines, and that it finds ready sale as land-plaster in Tulare and Fresno counties.

Paoli Mine.—This mine was examined by Professor Hilgard, who has been kind enough to supply the following information: "It is located in the ridge bordering the west side of the Great Valley, just north of Tome Creek, and about 5 miles south of the Big Panoche. It was discovered in 1892 by J. H. Hall, of Selma, and is owned and worked by the Paoli Gypsum Company, of Selma and Mendota, Fresno County, the location being about 18 miles S.W. from the latter station. The main ridge on which the gypsum appears at the highest level, extends about 300 ft. along the creek, to which it falls off steeply. Toward the north there extends from this ridge four spurs, from one third of a mile to one mile long, on the crests of which the gypsum crops out abundantly, with a gentle dip toward the valley. The deposit on the crest of the main ridge, where most work has been done, shows a thickness of at least 30 ft., but its lower limit has not been exposed. At the foot of the east slope of the third spur from the main summit, in a deep cañon, and 150 ft. vertically below the highest outcrop, there is a long exposure of a regular stratum about 18 ft. thick. Whether or not there exists a solid mass of the mineral from the outcrop to the summit, cannot be seen; should such be the case the mass would be enormous, but in any case the deposit is a very large one, sufficient to supply the needs of the San Joaquin Valley for a long time to come.

"The samples collected, which of course are essentially croppings, show the material to be very nearly uniform from top to bottom; a yellowish-white chalky mass, easily crumbled and therefore readily put in shape for farmer's use. Eight samples were selected to represent the outcrops on the crests of the several ridges and also the one in the cañon mentioned above. The analysis of four of these gave the following results:

	Gypsum.	Clay.	Sand, Moisture, and Carbonate of Lime, etc.
No. 1, from summit of main ridge	95.24	1.98	2.78
No. 5, from second spur middle of crest	94.74	1.52	3.74
No. 6, from third spur in cañon	92.90	2.60	4.50
No. 7, from fourth spur near road	82.20	8.21	9.59

"These results render superfluous the analysis of the other four samples taken. It is probable that had the sample No. 7 been taken farther from surface, most of the sand it contained would not have been found, since the rest contain none like it. Probably the average of the whole deposit ranges above 90 per cent, since the only one of the samples taken in the mass itself (No. 1, from the main workings thus far done) is the highest of all, and, counting out the 2 per cent or thereabouts of atmospheric moisture, is probably equal in purity to any gypsum thus far found in quantity west of the Sierra Nevada. Selected portions of the deposit will undoubtedly be available for burning into plaster of Paris for builders' use."

KERN COUNTY.

There are extensive deposits of impure gypsum in the foothills on both sides of the San Joaquin Valley, in Kern County. On the western side of the valley the principal deposits are situated in the S.E. borders of the Sunset Oil District. It occurs in a stratum of soft, chalky-looking rock, which in some places attains a thickness of several feet. A sample of this material, which was examined in the laboratory of the Mining Bureau, showed:

	Per Cent.
Gypsum	86.07
Calcium carbonate	11.07
Iron and alumina estimated as Fe_2O_3 and Al_2O_3	.50
Residue insoluble in acid	2.50

Another contained only 70 per cent of gypsum. It is said that other samples from this district have been found to contain less than 63 per cent of gypsum. The deposits of gypsum on the eastern side of the valley are found in the foothills of the Sierra, and present a similar appearance to the deposits of gypsum in the Sunset Oil District.

LOS ANGELES COUNTY.

Alpine Plaster Company of Los Angeles.—The gypsum mine owned by this company is situated in Antelope Valley, in the northern part of the county, distant about half a mile from Palmdale, on the S. P. R. R. The gypsum occurs as a superficial stratum about 25 ft. in thickness, and covers an area of about 25 acres; it is mined by surface workings, 2 men being employed. It is shipped to Los Angeles, where it is ground in a mill belonging to the company; 5 men are employed in this mill. The plant consists of one steam plaster mill having a capacity of 10 tons per twenty-four hours. The products of the mill are as follows:

Name of Substance.	Average Monthly Sales 1893-94.	Price f. o. b. Cars at Los Angeles in Carload Lots.
Plaster of Paris	15 tons.	$18 a ton.
Wall-plaster	20 tons.	11 a ton.
Fertilizer (land-plaster)	100 tons.	7 a ton.

RIVERSIDE COUNTY.

Banning.—The California Portland Cement Company, of Los Angeles, have commenced to manufacture plaster of Paris from a gypsum deposit near Banning. The works are at Colton, where the cement works are also located.

SAN LUIS OBISPO COUNTY.

On Alamo Creek.—Gypsum is found on Alamo Creek, 16 miles from Santa Maria. Beds of gypsum are scattered over an area of 40 acres; some of them are white and some gray. They occur in irregular veins like that at Point Sal, and in a similar formation. Developments consist of short tunnels and open cuts.

SANTA BARBARA COUNTY.

Owen Gypsum Company.—The vein of gypsum is on the east side of Santa Barbara Cañon, on the northern slope of the Cuyama range. It is of good quality, some of it being almost as clear as alabaster and faintly mottled, and is capable of taking a good polish. The outcrop is much broken, and the development does not yet show whether it is present in quantity sufficient to pay for working. The distance from market would be one great drawback. The bed is inclosed in Tertiary clays, which in this region, and particularly on the north side of the Cuyama River, are generally impregnated with gypsum in the form of selenite.

Point Sal Gypsum Mines.—These mines are idle at present, owing, it is said, to the cheapness with which the gypsum can be obtained in other places. Point Sal consists of an axis of crystalline rocks, on which rest the Tertiary clays and sandstones, dipping away in various directions. The bunchy gypsum veins are found in the clays. They are not well exposed at present, as all the old workings have caved in. See our VIIIth Report, p. 538, and Xth Report, p. 601.

IRON.

While iron ores have been found in many of the counties of the State, and in several instances in extensive deposits, lack of suitable cheap fuel has generally prevented their being utilized. Some years ago an extensive plant was put up in Placer County, where charcoal was used for fuel, but upon the destruction of the furnaces, etc., by a fire, operations ceased. A few hundred tons of iron ore from Shasta County were used by local rolling mills and foundries in 1893, but aside from this there was no production.

AMADOR COUNTY.

Ione Coal and Iron Company.—A thin bed of bog iron occurs in the Cretaceous hills at and north of Carbondale. The largest outcrop is about 18 in., and as it contains a large amount of silica it is worthless.

HUMBOLDT COUNTY.

Centerville.—In the gray metamorphic sandstones on the beach, 4 miles S. of Centerville, occur veins of hematite. One of them, exposed by the action of the surf, is 8 ft. thick. Thin seams of calcite make up one fourth of the mass. The strike is E. and W. at right angles to the coast-line, and the dip is 85° N. The ore is soft, of brown-red color, and has a tendency to become scaly like micaceous iron. The second vein is represented by bowlders of ore lying on the beach about 1 mile N. of the other. The cropping is covered up by a landslide. The float shows a better quality of ore, free from visible calcite. The third vein occurs about half a mile S. of the first one, and the cropping is also covered up. Large masses of ore in the mouth of a little gulch are the only evidences of its existence. Some of it is ground and used as mineral paint in the vicinity, for which it seems well adapted.

Preston Iron Mine.—On James Creek, 2 miles N.E. of Arcata, some prospecting has been done for iron. The rocks in this vicinity are decomposed serpentines and highly metamorphosed sandstones, containing iron and quartz. The soil, covering the hills from 6 to 15 ft. deep, is stained red with iron. The prospect work consists of a hole 4 ft. in diameter and 20 ft. deep, and a crooked tunnel 45 ft. in length, to meet it at the bottom. The shaft for the greater part of its depth is undoubtedly in ore, but the tunnel shows none at all. The strata dip 65° N.E. and the tunnel runs in S.W., so that should a regular vein exist, the tunnel would cut it at a point between 20 and 40 ft. from the mouth. It is possible that the ore found in the shaft has slid down the hill in a body—slides being frequent here—and that a vein exists higher up the hillside. The quality of the ore seems fair—a soft red hematite—but whether it exists in sufficient quantities to make the deposit of commercial value has yet to be demonstrated. Another opening has been made in the next gulch south, but no considerable body of iron found, the quartzose sandstone being merely stained by iron and manganese.

INYO COUNTY.

Argus Range, East Slope of.—About 5 miles S. of the mouth of Shepard's Cañon, and almost on the edge of Panamint Valley, is a considerable body of hematite iron, seemingly of excellent quality. It lies near the contact of limestone and granite. The iron appears in the form of bunches of varying size over an area several hundred feet in diameter. It is said to carry a trace of gold. It was used as a flux years ago in the Lookout smelter. Nothing but surface work has been done, so that its downward extent is not known.

Mountain Spring Cañon.—On the south side of Mountain Spring Cañon, near its head, is a ledge of hematite iron running E. and W. The float is very abundant, but the croppings are mostly covered, so that the extent is not known. It is inclosed in granite.

Shepard's Cañon.—A vein-like deposit of hematite outcrops in Shepard's Cañon, in the Argus range. It occurs in mica schist near the contact with granite. The deposit is apparently not very extensive.

LOS ANGELES COUNTY.

Mount Gleason Deposits.—On the south slope of Mount Gleason, near the head of Little Tejunga Cañon, is the Padre claim. At the western base, half a mile from Ravenna Station, good magnetic iron ore is found. None of the deposits appear to be very extensive, but in each the ore is of good grade.

SAN BERNARDINO COUNTY.

West Lava Beds District.—About 26 miles S.E. of Daggett, in this district, are large deposits of hematite and magnetite of superior quality. It has been proposed several times to open these deposits for the purpose of manufacturing iron, but never undertaken. The main shaft of the cruiser "Monterey" was made from ore taken from these mines. See our IXth and XIth Reports, pp. 235 and 349. Neeley et al., of San Diego, owners.

NAPA COUNTY.

Iron Mine Company.—Their property is situated at the head of Sulphur Creek, and comprises 400 acres on a range coursing N. and S., composed largely of green and red jaspery rock, through which veins of hematite course in an E. and W. direction. Some surface openings have been made, showing a 3½ ft. vein.

Clay Iron Ore.—It is found on the N.E. slope of the mountain flanking Conn Valley. No mining has been done here.

SHASTA COUNTY.

Lost Confidence Company's Mine.—A body of hematite, covering about 40 acres, is situated near Slick Rock Creek, running parallel with the silver ore outcrop. It is very pure and could be delivered on the cars at the bank of Sacramento River through an inclined tramway at a small expense.

Maxwell Mine.—This is 1¾ miles E. of the United States fishery, and comprises five claims. The ore body lies in limestone and is extensive, containing largely magnetic iron; it has a general E. and W. course.

Potter Mine.—This is 1½ miles E. of the United States fishery, on McCloud River, and comprises three claims. The ore body runs E. and W., in a large limestone belt, and carries principally magnetic iron with some limonite and brown iron ores. Analyses are said to show a trace of phosphorus but no sulphur, except near the river, a little silica, and an average of 70 per cent iron.

SONOMA COUNTY.

Fisk's Mill.—Three miles inland, on the Lancaster ranch, a body of iron ore has been slightly exploited, which is a part of an ore body running W. and S. along the coast for miles.

Fort Ross.—Six miles E. of Fort Ross is a body of iron ore, mostly hematite, coursing N., of considerable extent.

Nobles.—Five miles N. of Mr. Noble's ranch, near the West Fork of Gualala River, is a large body of hematite and silicate of iron.

MAGNESITE.

This mineral occurs in large deposits at several places in California, though it is not abundant elsewhere in the United States. The entire domestic production is from this State, though but one of the many known deposits is worked—that at Childs Valley, Napa County. Nearly all the raw ore is used locally by the Pacific Rolling Mills for furnace linings. Did freight rates permit, a good market for the ore could be found in Pittsburg, Pa., which now uses imported ore for furnace linings. The calcined ore made at the Snowflake Mine, Childs Valley, is utilized in the manufacture of paper from wood pulp, in which it is used as a bleaching agent. Some little of the raw ore has been here used experimentally in the manufacture of artificial stone, paint, Epsom salts, flocculent magnesia, and in other chemical processes. It takes about two tons of raw to make one of calcined ore.

NAPA COUNTY.

Berthenia Mine.—This property, 1,500 by 600 ft., is in Soda Valley, 12 miles E. of Rutherford, in Sec. 25, T. 8 N., R. 4 W. The fissure strikes N. 40° W. and dips E. 55°, carrying 3 ft. of a fine quality of magnesite. The croppings can be traced for several miles. Only surface work has been done. C. D. Mooney and S. H. Delmater, of Chile, owners.

Snowflake Mine.—It is in Childs Valley, adjoining the Phelan ranch, and about 2½ miles in an air line from the Berthenia, comprising 40 acres, apparently on the same fissure, as the strike and dip are practically the same as the Berthenia. The main fissure is 5 ft. wide, but near the surface, especially on the foot-wall side, the soil for many feet is filled with nodules of magnesite, cemented together in part by iron sinter. There have been 3,000 tons extracted, and about 150 tons are at present on the dump. A furnace to calcine 5 tons per day is on the ground. The main works are about 150 ft. above the valley road. Usually 10 men are employed. About 40 tons of magnesite has been manufactured into Epsom salts and flocculent magnesia by the Golden City Chemical Works, of San Francisco. W. H. Whitton et al., of St. Helena, owners.

Another magnesite deposit, about 1 mile S., has been discovered, but no work has been done. This mine is called the Cleveland.

SANTA CLARA COUNTY.

Magnesite occurs in this county in numerous places, but none of the deposits are at present being worked, and but few of them are opened at all. The *Jarvis* and *Mammoth* magnesite claims, situated on the Cerro Colorado, or Red Mountain, have been described in our XIth Report, p. 374. Neither of these properties have been worked since the last report.

On the ranch of M. H. Hyland, 9 miles S.E. of San José, there are croppings of magnesite, which are 10 to 15 ft. wide and 300 ft. in length. No development work has been done on the deposit.

On the property of the *North Almaden Mining Company*, near the place above, are croppings of magnesite.

The mineral occurs in small bunches in many places in the serpentine, in various parts of the county.

MANGANESE.

ALAMEDA COUNTY.

Bartlett Mine.—It is in Mitchell Cañon. See our IXth Report, p. 121. It was idle the past two years. There are "prospects" in Mitchell Cañon, near Corral Hollow, that are not developed.

Estacio Mine.—It is on the ranch of Belcher F. Estacio, 8 miles S.E. of Livermore, on the Cedar Mountain road. This is a new prospect, and very little work has been done and no ore shipped. A small cut exposes a mineral body 8 ft. wide, in which occurs some good and a great deal of poor manganese ore. About 100 yds. W. croppings 6 to 8 ft. wide are again seen, but nothing has been done at this latter place. The owners are making preparations to open their property during the summer of 1894.

Mendenhall Mine.—This is half a mile S. of the Cedar Mountain road, and 11 miles S.E. of Livermore; it is not working. In 1893 this mine produced 120 tons of good ore. The vein becoming very narrow, work was suspended and has not been resumed.

Merchant Mine.—This is 11 miles S.E. of Livermore, in Sec. 21, T. 4 S., R. 3 E., M. D. M. This deposit was discovered quite recently. Four men are employed. There are several deposits in the vicinity, only two of which are opened and worked. The one making the best showing strikes E. and W., and is about 1 ft. in width. The ore is clean and high grade. The mine has produced, up to April 1, 1894, about 60 tons of fine ore, and the owner feels confident of securing at least 100 tons more. The product of this mine is bought by Messrs. Taylor & Pitcher at Livermore. These gentlemen contemplate the erection of a plant to grind and cleanse manganese ore, in which they deal quite extensively.

Taylor & Pitcher Mine.—This is in Corral Hollow. In 1893 it produced 150 tons of ore. The mine was shut down in the latter part of that year, and has not been operated since. The mine has produced, in all, 300 tons.

MARIN COUNTY.

On the *Mailliard Ranch*, about 7½ miles W. of San Rafael, is a deposit of black oxide of manganese. The ores are chiefly pyrolusite and psilomelane. The deposit was opened superficially years ago, but of late nothing has been done with it. The owner was negotiating with dealers in the spring of 1894, and was considering the advisability of opening the deposit. It is 1½ miles from the railroad station at San Geronimo. A good wagon road passes within a short distance of the deposit, which, from surface indications, is quite extensive.

Manganese also occurs on the hillside near Sausalito, but it has not been worked in a very long time.

NAPA COUNTY.

Manganese Deposit.—It is on the N.E. side of Conn Valley, cropping out about 200 yds., and nearly 60 yds. wide.

SAN BENITO COUNTY.

Cleveland Manganese Mine.—This is a deposit recently discovered. It is located just over the summit on the eastern slope of the Coast Range, 20 miles E. of Tres Pinos, and about 3 miles E. of the Los Muertos ranch. Red jasper occurs, impregnated with manganese, over an area of 100 ft. in diameter. On one side of this area the manganese is found almost wholly replacing the jasper in an irregular vein, from 2 to 4 ft. in thickness. But little work has been done and the extent of the deposit is not determinable.

SAN LUIS OBISPO COUNTY.

A half mile S.E. of the Profumo iron deposit, and about 4 miles W. of San Luis Obispo, is a small outcrop of manganese. It occurs impregnating a stratum of jasper, which is probably a continuation of that containing the iron. In a portion of the deposit the manganese is of a very high grade.

SANTA CLARA COUNTY.

On *Penitentia Creek*, about 3 miles above Alum Rock, is a huge bowlder of manganese. It lies on a low terrace near the creek, and was at one time supposed to be the cropping of a large vein, for which an enterprising citizen of San José paid dearly. The main ledge from which it came is supposed to be one of those near the head of the creek, about due north from Mount Hamilton. In that vicinity there are several deposits of manganese of good quality, but nothing has been done on them for years.

A deposit of manganese occurs on the ranch of *R. Foville*, which is described in our XIth Report, p. 374. Nothing has been done with this deposit.

SONOMA COUNTY.

Shaw's Mine.—Situated 7 miles N.W. from Cloverdale is a body of very pure manganese ore (60 to 80 per cent) cropping out about 10 ft. wide, between slate and limestone, with a N.W. course. Open cuts have been made on the croppings and 50 tons of good ore are on the dump; none has been shipped and the mine is not worked. J. E. Shaw, of Cloverdale, owner.

MINERAL SPRINGS.

ALAMEDA COUNTY.

Piedmont White Sulphur.—They are about 3 miles from Oakland, and have gained considerable local reputation as medicinal waters. Analyses by Winslow Anderson, M.D.:

	Iron Spring.	White Sulphur.
	Grains per U. S. Gal.	Grains per U. S. Gal.
Sodium chloride	5.10	7.91
Sodium bicarbonate	11.70	9.40
Sodium carbonate	.52	6.20
Potassium carbonate	3.15	.76
Potassium iodide	Trace.	Trace.
Magnesium carbonate	6.37	3.17
Magnesium sulphate	1.03	17.80
Calcium carbonate	2.13	3.32
Calcium sulphate	1.60	7.09
Ferrous carbonate	1.73	Trace.
Alumina	.45	Trace.
Borates	5.23	1.90
Silicates	4.19	5.06
Organic matter	Trace.	Trace.
Total solids	43.20	62.61
Carbonic acid gas	7.25 cu. in.	4.60 cu. in.
Sulphuretted hydrogen	Trace.	9.25 cu. in.

COLUSA COUNTY.

Clark's.—See our Xth Report, p. 159.

Simon's Hot Sulphur.—They are located in Sulphur Cañon, near Wilbur Springs. The waters have a temperature of 170° F. and are highly charged with sulphuretted hydrogen.

Wilbur Springs.—They are 30 miles from Colusa, and are pleasantly situated and have acquired considerable reputation from their therapeutic properties. The resort is reached by railroad to Williams and thence by stage. Analysis by Winslow Anderson, M.D.:

	Grains per U. S. Gallon.
Sodium chloride	19.75
Sodium carbonate	3.40
Sodium sulphate	26.19
Potassium chloride	.46
Potassium iodide	.75
Magnesium carbonate	5.10
Magnesium sulphate	22.90
Calcium carbonate	8.44
Calcium sulphate	20.62
Ferrous sulphate	4.16
Alumina	3.93
Silicates	6.95
Organic matter	1.74
Total solids	124.39
Sulphuretted hydrogen	43.97 cu. in.

CONTRA COSTA COUNTY.

Byron Springs.—These famous springs are pleasantly situated near the foothills in the spur of the Coast Range Mountains, about 16 miles S.E. of Mount Diablo, and about 1½ miles from Byron Station. The

springs lie in a small valley leading from the San Joaquin plains. The surrounding hills are composed of calcareous shales. The valley is covered with adobe clay and fine white sand, through which the springs bubble. They are among the many natural wonders in our State, and being only three hours' ride from San Francisco, are much visited by tourists.

Dr. Winslow Anderson, who has made the following analyses, states that there are more than fifty springs or outlets from the subterranean passages; some are cold and others are hot, ranging from 50° to 140° F. Within a few feet of each other there will be a cold carbonate spring and a hot sulphuretted spring. The cold soda springs come from the surface water, but the hot water (sulphuretted) must come from a considerable distance down in the earth's crust.

"Liver and Kidney Spring."

	Grains per U. S. Gallon.
Sodium chloride	622.07
Potassium chloride	33.74
Potassium iodide	.79
Potassium bromide	Trace.
Magnesium chloride	3.92
Magnesium carbonate	15.73
Calcium chloride	85.37
Calcium sulphate	1.12
Calcium carbonate	.59
Barium carbonate	.93
Ferrous carbonate	.72
Ammonium chloride	3.05
Silica	1.00
Organic matter	Trace.
Total solids	769.05
Free carbonic acid gas	7.82 cu. in.

White Sulphur Spring.

Temperature, 76° F.	Grains per U. S. Gallon
Sodium chloride	12.01
Sodium bicarbonate	12.94
Sodium sulphate	1.34
Potassium chloride	Trace.
Potassium carbonate	2.37
Potassium sulphate	Trace.
Magnesium chloride	Trace
Magnesium carbonate	2.50
Calcium carbonate	1.13
Ferrous carbonate	3.00
Silica	.26
Organic matter	Trace
Total solids	36.06
Carbonic acid gas	21.17 cu. in.
Sulphuretted hydrogen	5.80 cu. in.

EL DORADO COUNTY.

Glen Alpine.—They are in a wild rugged gorge, 7 miles from Lake Tahoe, altitude 6,700 ft. The gorge is filled throughout its entire length with varied scenes of beauty and grandeur, and terminates abruptly in a glacial amphitheater. Analysis by Winslow Anderson, M.D.:

Carbonated and Chalybeate.

	Grains per U. S. Gallon.
Sodium chloride	21.17
Sodium carbonate	32.75
Potassium carbonate	Trace.
Magnesium carbonate	9.96
Calcium carbonate	45.09
Calcium sulphate	4.10
Ferrous carbonate	1.80
Alumina	1.43
Borates	Trace.
Silica	2.50
Organic matter	Trace.
Total solids	118.80
Free carbonic acid gas	138.36 cu. in.

FRESNO COUNTY.

Fresno Hot Springs.—See our Xth Report, p. 189.

HUMBOLDT COUNTY.

Felt's Springs.—They are on the side of the mountain, 1 mile W. of Strong's Creek and 5½ miles N.E. from Fortuna, in T. 3 N., R. 1 E. Fire has destroyed the hotel twice, and the improvements now consist of the bath-house and several small cottages for campers. There are three springs close together. The one farthest to the north is small but strongly impregnated with sulphur. The other two have an alkaline taste and a milky color.

Humboldt Artesian Mineral Water Company.—The well is situated at the edge of the bay, at Flannagan's mill, south of Eureka. It is 170 ft. deep and is double cased with 8 in. and 5 in. pipe. The flow, augmented by pumping, is estimated at 60,000 gallons per day. The water is charged artificially with carbonic acid under pressure of 30 to 130 lbs., according to size of bottles. It has an agreeable saline taste and finds a ready market in San Francisco and elsewhere as a table water.

Analysis of Water from Humboldt Artesian Mineral Spring.

	Grains per Imperial Gallon.
Sodium chloride	32.91
Calcium carbonate	16.37
Magnesium carbonate	10.63
Sodium carbonate	2.45
Silica	1.32
Alumina	.20
Iron oxide	.06
Sulphates	Traces.
Organic matter	Trace.
Carbonic acid	Abundant.

The water analyzed was purchased in open market, and the analysis shows the quality of the water furnished to the public. It differs from many natural mineral waters in the fact that it does not contain a single injurious ingredient.

WM. D. JOHNSTON, M.D.,
Professor of Chemistry, etc., Cooper Medical College.

INYO COUNTY.

Boiling Springs.—On the east side of Dry Salt Lake are several hot boiling alkaline springs.

Saratoga.—At the south end of Funeral range, and a little south of Death Valley, are located these pleasant springs. The resort, in spite of the uncanny names, is a good one and constantly growing in popularity.

Sulphur.—They are 6 miles S. of McComrich's well, in Desert Valley.

Thermal Acid.—These remarkable springs are found in the Coso range, 12 miles E. of Little Owens Lake. The soil around the springs is rich in pure crystallized sulphur.

Volcanic Mineral.—In Death Valley are several remarkable springs. Analysis by Prof. T. Price:

	Grains per U. S. Gallon.
Sodium chloride	1,840.72
Sodium carbonate	1,724.11
Sodium sulphate	651.02
Sodium sulphide	46.34
Potassium chloride	132.31
Magnesia and lime	Traces
Silica	14.25
Organic matter	13.45
Iodine	Traces.
Bromine	Traces.
Iron	Traces.
Boracic acid	Traces.
Phosphoric acid	Traces
Total solids	4,422.25

Gases not determined.

KERN COUNTY.

Agua Caliente.—Thirty miles from Caliente Station are sulphuretted waters; temperature from 80° to 100° F.

Warm Springs are found in this county near the head of Walker's Basin.

Warm Sulphur.—On Poso Creek, near Simmons Valley, are warm sulphur springs, the waters of which are used locally for rheumatism and cutaneous affections.

LAKE COUNTY.

Adams Springs.—These are 8 miles S. of Clear Lake, and are mentioned in our VIIIth Report, p. 327, with analysis of the waters by Prof. T. Price.

Allen Springs.—Situated near the head of Cache Creek are five springs. An analysis of one of these by Dr. Winslow Anderson shows:

Temperature, 58° F.	Grains per Gallon.
Sodium chloride	23.16
Sodium bicarbonate	4.25
Sodium sulphate	.73
Potassium chloride	1.90
Magnesium bicarbonate	27.40
Potassium bicarbonate	.75
Magnesium chloride	.63
Calcium bicarbonate	20.14
Calcium phosphate	.55
Ferrous carbonate	.93
Organic matter	Trace.
Total solids	84.20
Carbonic acid gas	36 cu. in.

Anderson Springs.—They are 5 miles from Middletown, at the head of Lacoma Valley. They consist of nine mineral springs. The analysis of one of the springs by Dr. Winslow Anderson is as follows:

Temperature, 63° F.	Grains per Gallon.
Sodium chloride	1.09
Sodium carbonate	9.27
Sodium sulphate	6.18
Potassium salts	Traces.
Magnesium carbonate	11.73
Magnesium sulphate	16.95
Calcium carbonate	20.40
Calcium sulphate	9.10
Ferrous carbonate	.46
Arsenious salts	Traces.
Silica	2.45
Organic matter	Traces.
Total solids	77.63
Carbonic acid gas	243.50 cu. in.
Sulphuretted hydrogen	4.20 cu. in.

Iron Spring. (Analysis by E. G. Colby.)

Temperature 124° F.	Grains per U. S. Gallon.
Sodium chloride	.183
Sodium bicarbonate	.196
Sodium sulphate	3.421
Potassium sulphate	1.168
Magnesium sulphate	7.359
Calcium sulphate	10.884
Calcium phosphate	.154
Ferrous carbonate	1.184
Alumina	.093
Boracic acid (spectroscope)	Strong test.
Lithium (spectroscope)	Well-marked test.
Manganous carbonate	1.772
Silica	4.217
Organic matter	Small.
Total solids	30.631
Free carbonic acid gas	25.80 cu. in.

Bartlett Springs.—They are near the head of Cache Creek, in the northeastern part of the county. The following analysis is by Dr. Winslow Anderson:

Temperature, 54° F.	Grains per U. S. Gallon.
Sodium chloride	.54
Sodium bicarbonate	1.21
Potassium bicarbonate	.36
Magnesium carbonate	7.74
Magnesium sulphate	1.62
Calcium carbonate	29.07
Calcium phosphate	.50
Calcium sulphate	.63
Ferrous carbonate	.51
Barium carbonate	Traces.
Silica	3.73
Lithium	Traces.
Borates	Traces.
Organic matter	Trace.
Total solids	45.91
Carbonic acid gas	224.56 cu. in.

Bonanza Springs.—See our VIIIth Report, p. 327.

Harbin Springs.—Situated 4 miles N.W. of Middletown, contains sulphurous and saline waters. Dr. Winslow Anderson gives the following analyses of the hot sulphur and other springs:

Temperature, 122° F.	Grains per U. S. Gallon.
Sodium chloride	23.05
Sodium carbonate	5.42
Sodium sulphate	10.19
Potassium carbonate	1.74
Magnesium carbonate	6.18
Magnesium sulphate	11.94
Calcium carbonate	9.10
Calcium sulphate	14.63
Ferrous sulphate	1.75
Arsenious salts	.07
Alumina	1.00
Silica	2.76
Organic matter	Trace.
Total solids	88.63
Carbonic acid gas	4.26 cu. in.
Free sulphuretted hydrogen	11.74 cu. in.

Magnesia Spring.

Temperature, 60° F.	Grains per U. S. Gallon.
Sodium chloride	1.72
Sodium carbonate	5.17
Sodium sulphate	4.32
Potassium salts	1.06
Magnesium carbonate	7.15
Magnesium sulphate	15.92
Calcium carbonate	8.43
Calcium sulphate	.93
Ferrous carbonate	.27
Arsenic	Trace.
Alumina	.68
Lithium	Trace.
Borates	Trace.
Silica	2.82
Organic matter	Trace.
Total solids	48.46
Free carbonic acid	17.25 cu. in.

Iron Spring.

Temperature, 116° F.	Grains per U. S. Gallon.
Sodium chloride	7.50
Sodium carbonate	14.22
Sodium bicarbonate	1.45
Sodium sulphate	5.25
Potassium chloride	Trace.
Potassium carbonate	1.78
Magnesium carbonate	4.16
Magnesium sulphate	6.11
Calcium carbonate	2.07
Calcium sulphate	Trace.
Ferrous carbonate	1.90
Alumina	.73
Silica	1.41
Organic matter	Trace.
Total solids	46.53
Carbonic acid gas	9.34 cu. in.

Highland Springs.—These are 8 miles S. from Lakeport, on the west side of Clear Lake, and are over twenty-five in number. The analyses of the five principal ones, made by Professor Rising, of the University of California, are given in our VIIIth Report, p. 328.

Howard Springs.—There are fourteen altogether, situated 6 miles from Lower Lake. The following analyses were made by Prof. W. T. Wenzell:

	Excelsior.	Twins.	Eureka.	Neptune.	Soda.
Temperature	75° F.	102° F.	110° F.	85° F.	60° F.
Free carbonic acid, cu. ins. per gallon	134.00	77.50	150.00	120.00	117.00
Solids. (In grains per U. S. gallon.)					
Chloride of sodium	101.67	30.96	35.70	29.61	9.38
Chloride of potassium	1.13	19.71	25.65	14.64	12.81
Chloride of lithium	.35	.03	.09	.06	----
Bicarbonate of soda	34.10	73.97	82.35	----	37.72
Bicarbonate of magnesia	2.81	114.10	110.25	73.34	59.32
Bicarbonate of lime	6.30	10.88	5.84	32.14	35.62
Bicarbonate of iron	1.85	1.14	----	----	----
Alumina	.03	.15	.10	.19	.13
Oxide of iron	----	----	4.95	.20	.09
Silica	34.10	9.24	3.40	8.34	6.95
Organic matter	.14	.32	.20	.25	.20
Totals	182.48	260.50	268.53	158.77	162.22

Mills Springs.—See our VIIIth Report, p. 328.

Saratoga Springs.—See our VIIIth Report, p. 328.

Seigler Springs.—See our VIIIth Report, p. 328.

Witter Mineral Springs.—There are several springs, the principal one, known as the Dead Shot, has been analyzed by Dr. Winslow Anderson, as follows:

Temperature, 59.3°.	Grains per Gallon.
Sodium chloride	17.42
Sodium carbonate	5.96
Sodium sulphate	11.50
Potassium carbonate	3.15
Magnesian carbonate	7.10
Magnesian sulphate	20.62
Ferrous carbonate	1.17
Manganese carbonate	.86
Alumina	1.65
Borates	.42
Silica	6.33
Organic matter	.76
Total solids	76.94
Carbonic acid gas	7.65 cu. in.
Sulphuretted hydrogen	5.25 cu. in.

LASSEN COUNTY.

Big Hot.—It is 3 miles N. of Honey Lake, and is a large hot saline spring, several feet in diameter; temperature, 200° F. The water is constantly boiling up in a large stream.

Brenbeck's Boiling.—On the east side of Honey Lake is one large boiling alkaline spring.

High Rock.—Nine miles E. of Honey Lake; alkaline water; temperature, 100° F.

Mud Springs.—Extensive hot mud springs are situated 15 miles N.E. of Honey Lake.

Shafer's Hot.—They have a temperature of 210° F., and contain salines and sulphates; are situated at the north end of Henry Lake.

LOS ANGELES COUNTY.

Encino Springs.—On the Encino ranch, near Los Angeles City, are a number of warm alkaline and carbonated springs, having a temperature of 90° F. Analysis by Oscar Loew:

	Parts in 1,00.
Sodium carbonate	24.31
Calcium carbonate	32.17
Sodium sulphate	54.46
Sodium chloride	2.93
Silica	11.50
Total solids	125.37

Carbonic acid in excess.

Fulton Wells.—These wells are 13 miles from Los Angeles City. The two principal wells are 350 ft. deep and flow copiously. Analysis by Winslow Anderson, M.D.:

	Grains per U. S. Gallon.
Sodium chloride	9.60
Sodium bicarbonate	2.90
Sodium sulphate	.95
Magnesium bicarbonate	17.45
Ferrous carbonate	11.75
Calcium carbonate	12.62
Calcium sulphate	23.41
Silica	2.45
Organic matter	Trace.
Total solids	81.13

MENDOCINO COUNTY.

California Seltzer Springs.—They are 12 miles from Cloverdale, with picturesque surroundings. The waters are sparkling and carbonated. Analysis by Winslow Anderson, M.D.:

Temperature, 57° F.	Grains per U. S. Gallon.
Sodium chloride	17.15
Sodium bicarbonate	53.00
Magnesium carbonate	44.60
Calcium carbonate	72.40
Ferrous carbonate	Trace.
Silica	Trace.
Organic matter	Trace.
Total solids	187.15
Free carbonic acid gas	18.00 cu. in.

Duncan Mineral Springs.—They are 1¼ miles S.W. of Hopeland, on the S. F. & N. P. R. R. There are seven springs, and the chief mineral constitutents are magnesia, lime, and soda, held in solution by free carbonic acid gas. O. Howell, of Hopeland, owner.

Vichy Springs are situated in Doolan Cañon, 3 miles N.E. from Ukiah. The water issues from under a bed, 15 to 20 ft. thick, of calcareous tufa, and is thence conveyed through wooden pipes to the bath-houses. It has a peculiar alkaline but not disagreeable taste, and is rather liked by visitors. There are three springs; the upper one (Crystal Spring), is cold and is not used for bathing. The Vichy Spring is the largest, yielding about 20 in. of water. The Ardeche Spring yields about 8 in. of water. The last two are warm and are used in the baths. Surrounding the baths are several hotel buildings and cottages. The grounds have been

tastefully arranged so as to give shade and comfort during the heat of the day.

Vichy Spring. (Analyzed by Winslow Anderson, M.D.)

Temperature, 93° F.	Grains per U. S. Gallon.
Carbonate of soda	195.52
Carbonate of lime	18.14
Carbonate of magnesia	19.75
Carbonate of iron	.07
Chloride of sodium	28.60
Chloride of potassium	.09
Silica	5.92
Total solids	224.75
Free carbonic acid gas	224.75 cu. in.

Crystal Spring. (Analyzed by Prof. Thos. Price.)

Temperature, 45° F.	Grains per U. S. Gallon.
Carbonate of soda	142.69
Biborate of soda	9.25
Chloride of sodium	22.51
Chloride of potassium	2.11
Carbonate of lime	21.69
Carbonate of magnesia	11.66
Carbonate of iron	.96
Silica	1.86
Total solids	212.73

Ukiah Water Supply.—A pumping plant has been established on the bank of Russian River. The water, which is clear and pure, is raised from a shallow well (20 ft.) to a 250,000 gal. reservoir, 200 ft. above the town, and thence brought through a 10 in. pipe to the consumers.

MODOC COUNTY.

Alkaline Lakes.—Several large sheets of alkaline waters fed by springs are found 15 miles S.E. of Alturas.

Boyd's Hot.—They are in Surprise Valley; the waters are alkaline and heavily charged with carbonic acid gas.

Coal Valley Boiling.—They are 8 miles W. of Canby, and are truly boiling, having a temperature of 214° F.

Stuart's Hot.—They are located in Warm Spring Valley, and are attracting considerable attention.

MONO COUNTY.

Alkali.—Several alkali springs are found in the north end of the county.

Benton Hot.—They are near Benton, and one of them has a diameter of 18 ft.; temperature, 135° F. The waters are slightly alkaline, and much used for bathing purposes.

Black Lake.—It is 1 mile W. of Benton, and is fed by several springs. The water is sulphuretted and saline.

Boiling Sulphur.—There are several sulphuretted alkaline boiling springs on the south branch of Owens River, N.W. of Long Valley.

Casa Diablo Hot.—These are 10 miles E. of Mammoth. The waters are saline and sulphuretted. Farther up the road are a number of small steaming boiling geysers.

Mono Basin Warm.—These waters are chlorinated and alkaline, and are located on the northeast shore of Mono Lake.

Mono Lake.—This is 14 miles in length; its greatest breadth is 9 miles. Analysis by Dr. Winslow Anderson:

	Grains per U. S. Gallon.
Sodium chloride	795.24
Sodium carbonate	26.40
Sodium sulphate	17.10
Sodium phosphate	5.93
Potassium chloride	281.17
Potassium carbonate	10.60
Potassium phosphate	3.05
Magnesium chloride	365.60
Magnesium carbonate	9.45
Magnesium sulphate	127.50
Calcium chloride	1,075.55
Calcium carbonate	52.76
Calcium sulphide	Trace.
Calcium sulphate	57.07
Ferrous carbonate	7.14
Alumina	26.63
Borates	19.73
Silicates	9.62
Organic matter	24.60
Total solids	2,915.16
Free carbonic acid gas	17.16 cu. in.
Free sulphuretted hydrogen	.62 cu. in.

MONTEREY COUNTY.

Bane's Soda Springs.—These are about 6 miles S.W. of the Cruikshank mines, on a steep hill facing the ocean. Springs bearing lime in solution, and leaving a heavy deposit of aragonite, issue for a long distance along the cliffs in this vicinity. The main spring is richly impregnated with carbonic acid and iron, in addition to other ingredients. It has formed a very beautiful terrace on the steep slope, the terrace rising 20 ft. almost vertically on its lower side and having a flat top. From the center of this flat top the spring issues and flows over and down the vertical face of the terrace, leaving a deep red stain, which extends even to the ocean, while 100 ft. above dripping lime water has formed a stalactitic cave. Another spring, carrying iron and carbonic acid, issues at the base of the cliffs near the ocean. These springs are accessible by road and rough trail from San Simeon.

Dolan's Hot Sulphur Spring.—This thermal spring is on the North Fork of Big Creek, in a deep redwood cañon about 1½ miles from the ocean. A large stream of warm sulphur water issues from the south side of the cañon, leaving a considerable deposit of a white ropy substance, similar to that of the White Sulphur Springs. The temperature is probably not over 100°. The spring is 7 miles down the coast from Slate's, over rough trails.

Helm's Soda Springs.—Three miles E. of Bane's Springs, at an elevation of 1,600 ft. above the ocean, is another series of springs, very richly impregnated with carbonic acid. The amount of water is not great, nor are there apparently any minerals present.

Paraiso Springs.—These springs are situated 7 miles S.W. of Soledad, in a cañon of the Soledad Hills. Here are a number of mineral springs, including warm and cold soda springs, the warm spring having a temperature of 118° F., and an iron spring, besides several others more or less mineralized. They are used for both drinking and bathing, more particularly the latter, being especially efficacious in cases of rheumatism.

Slate's Hot Sulphur Springs.—These springs are 20 miles below Point Sur. They issue from the side of a bluff facing the ocean, being scattered along a distance of a quarter of a mile. Several issue from the bed of Hot Spring Creek. The temperature of the hottest one is 130° F. and the volume of water great. The different springs show a somewhat varying composition. They issue from shale and sandstone of the pre-Cretaceous series, which is here considerably metamorphosed. The springs are accessible by trail from the Sur.

Tassajara Springs.—They are in a deep cañon, tributary of the Arroyo Seco, in the heart of the Santa Lucia Mountains. They are reached by road from Salinas, and by road and trail from Soledad up the Arroyo Seco. The elevation is about 1,400 feet. Here are eighteen springs, varying in temperature from 124° to 150° F. They issue from crystalline schists in the bed of the creek and southern bank. In addition to sulphur, the springs carry magnesia and some other minerals. They are used for both drinking and bathing, more particularly the latter, being especially efficacious in cases of rheumatism.

NAPA COUNTY.

Calistoga Springs.—See our VIIIth Report, p. 416. They consist of twenty hot salt springs, situated east of the town of Calistoga.

Etna Springs.—See our VIIIth Report, p. 416. They are at the head of Pope Valley, 16 miles N.E. from St. Helena, and comprise six springs. Their temperatures vary from 98° to 106° F.

Napa Soda Springs.—See our VIIIth Report, p. 416. These are 6 miles N.E. of Napa City. There are twenty-seven springs, and the waters are saline, with a temperature of 68° F.

Samuels' Soda Springs.—Situated 20 miles E. of St. Helena, on a branch of Pope Creek, in a narrow, steep cañon. An analysis made under Professor Hilgard's care gives the following:

	Grains per U. S. Gallon.
Silica	4.78
Potassium sulphate	2.99
Sodium chloride	21.35
Sodium bicarbonate	15.95
Lithium (with spectroscope)	Well-marked trace.
Calcium carbonate	1.24
Calcium sulphate	.25
Calcium phosphate	.58
Strontium carbonate (spectroscope)	Slight test.
Magnesian carbonate	37.78
Iron carbonate	.95
Boracic acid	Marked test.
Organic matter	Traces.
Total solids	85.87
Free carbonic acid gas	278.16 cu. in.

White Sulphur Springs.—See our VIIIth Report, p. 417. These are 2½ miles S.W. from St. Helena, with nine sulphuretted springs, the temperatures varying from 69° to 89° F.

PLACER COUNTY.

Rubicon Soda.—These mineral soda springs are romantically situated in Garden Valley, on the Rubicon River, about 11 miles W. of Lake Tahoe. Everything surrounding them partakes of the picturesque; the

tall mountains, covered with groves of pine and spruce, and capped by old century cedars. The mineral springs themselves belong to the alkalo-carbonated class of waters.

Summit Soda Springs.—They are located in an expansion at the head of the deep cañon along which winds one of the forks of the American River. The surroundings are exceedingly picturesque. The air is pure, dry, and invigorating, and cool and pleasant during the heated summer season; altitude, 6,009 ft. Analysis by Dr. Winslow Anderson:

	Grains per U. S. Gallon.
Sodium chloride	26.15
Sodium bicarbonate	4.11
Sodium carbonate	5.75
Potassium carbonate	.82
Magnesium carbonate	4.05
Calcium bicarbonate	38.93
Calcium carbonate	6.55
Ferrous oxide	----
Ferrous carbonate	2.70
Borates	Trace.
Alumina	1.13
Silica	1.94
Organic matter	Trace.
Total solids	92.16
Free carbonic acid gas	187.25 cu. in.

PLUMAS COUNTY.

Boiling Lakes.—Seven miles S. of Lassen's Peak are a number of hot bubbling and boiling alkaline springs. They are located quite close together, and several of them coalesce, forming lakes.

Cold Soda Lake.—This alkaline sheet of water is near the head of Mill and Battle creeks, S. of Lassen's Peak. It is fed by many small springs bubbling up all over its bottom. The water is palatable and sparkling.

Dr. Soupan's.—These hot sulphur springs are at the head of the road on a branch of Battle Creek. The surroundings are picturesque.

Geysers.—Near the mouth of Willow and Warner creeks are found a number of small geyser springs. The temperature is near the boiling point, and sulphurous steam and vapors rise from 20 to 50 ft. into the air.

Steamboat Springs.—S.E. of Lassen's Peak are located a number of boiling springs, which spout and puff as they issue from the earth's crust.

SAN BERNARDINO COUNTY.

Arrowhead Hot.—These springs are located 10 miles from Colton, in the San Bernardino Mountains; altitude, 1,600 ft. The springs number twenty or more and the combined volume of hot water issuing from the granite and limestone formation is very large. It has been likened to a good-sized millstream (Blake). The water is very hot, several springs having a temperature ranging from 108° to 210° F. The springs form one of the tributaries of the Santa Ana River.

Bitter.—This cool saline spring is situated 18 miles N. of Camp Cody. The water is rich in magnesium sulphate (Epsom salt), hence its name.

San Juan Capistrano.—These springs are light carbonated, and much used in the southern portion of the State. They are near Capistrano. Analysis by Oscar Loew:

	Parts in 100,000.
Sodium chloride	10.50
Sodium carbonate	11.10
Sodium sulphate	Trace.
Potassium carbonate	Trace.
Calcium carbonate	Trace.
Magnesium carbonate	Trace.
Lithia	Trace.
Silica	7.66
Total solids	29.29

SAN DIEGO COUNTY.

Agua Caliente.—These hot sulphuretted springs are on Warner's ranch, 50 miles from San Diego City. Analysis by Oscar Loew:

	Grains per U. S. Gallon.
Sodium carbonate	8.3
Sodium sulphate	Trace.
Sodium chloride	31.0
Lime	Trace.
Magnesia	Trace.
Lithia	Trace.
Silica	Trace.
Organic matter	Trace.
Total solids	39.3

Coronado Springs.—Analyses by C. Gilbert Wheeler:

	Coronado, Cal.	Bethesda, Wis.
	Grains per U. S. Gal.	Grains per U. S. Gal.
Sodium chloride	10.168	1.160
Sodium carbonate	----------	.872
Sodium sulphate	----------	.544
Potassium chloride	.912	----------
Potassium sulphate	.552	.456
Magnesium carbonate	4.728	7.344
Calcium carbonate	6.488	11.824
Calcium sulphate	1.328	----------
Ferrous oxide	.040	.032
Alumina	----------	.120
Silica	1.080	.728
Organic matter	.922	1.984
Total solids	26.288	25.064

Corral de Luz.—These sulphuretted warm springs are near Oceanside, in a valley about 8 miles from the ocean. The waters range in temperature from 85° to 135° F.

Dos Palmas.—The springs are in Coahuila Valley, and have an average temperature of 90° F. The mineral constituents are chiefly salt and sulphates of lime and magnesia.

Elsinore.—In a little valley close to Elsinore there are nearly two hundred springs, some cold and others nearly boiling. "The cold springs are carbonated, containing soda, magnesia, and iron; the hot waters are sulphurous, with lime, magnesia, and borax." (Dr. Winslow Anderson.)

SAN LUIS OBISPO COUNTY.

Arroyo Grande.—These springs are located 14 miles N. of San Luis Obispo City. The waters are alkaline and carbonated, and are much used locally.

El Paso de Robles.—These valuable hot and cold sulphur springs are in the beautiful valley of the Salinas River, 16 miles from the shores of the Pacific and 216 miles from San Francisco. The once wild "pass in the oaks" is now transformed into a blooming resort, with cultivated grounds, and Paso Robles is a delightful little town of about 1,000 inhabitants.

	Profs. Price and Hewston's Analysis, 1872.	Dr. Winslow Anderson's Analysis, 1889.
	Grains per Imp. Gal.	Grains per U. S. Gal.
Sodium chloride	27.18	25.73
Sodium bicarbonate	50.74	41.19
Sodium carbonate	----	7.62
Sodium sulphate	7.85	7.25
Sodium iodide	----	Trace.
Sodium bromide	----	Trace.
Potassium chloride	----	1.57
Potassium carbonate	----	2.05
Potassium iodide	----	Trace.
Potassium sulphate	.88	Trace.
Magnesian bicarbonate	.92	----
Magnesium carbonate	----	2.15
Magnesium sulphate	----	5.11
Calcium carbonate	----	1.23
Calcium sulphate	3.21	2.94
Ferrum peroxide	.36	.73
Borates	----	Trace.
Lithates	----	Trace.
Alumina	.22	.25
Silica	.44	1.75
Iodides and bromides	Trace.	----
Organic matter	1.64	1.90
Total solids	93.44	101.47
Free sulphuretted hydrogen	4.45 grains.	3.75 cu. in.
Free carbonated acid gas	10.50 grains.	8.90 cu. in.

Santa Ysabel.—Several of the most valuable mineral springs in the State are 2½ miles S.E. of Paso Robles; altitude, 1,000 ft. Analysis by Dr. Winslow Anderson:

	Grains per U. S. Gallon.
Sodium chloride	18.10
Sodium bicarbonate	29.04
Sodium carbonate	6.91
Sodium sulphate	7.25
Sodium iodide	Trace.
Potassium bromide	Trace.
Potassium iodide	Trace.
Potassium chloride	Trace.
Potassium carbonate	.83
Magnesium carbonate	6.16
Magnesium sulphate	4.85
Calcium carbonate	2.45
Calcium sulphate	2.32
Manganese carbonate	.13
Ferrous carbonate	.98
Borates	Trace.
Alumina	.73
Barium salts	Trace.
Silica	1.68
Total solids	81.43
Free sulphuretted hydrogen	4.65 cu. in.
Free carbonic acid gas	11.75 cu. in.

SANTA BARBARA COUNTY.

Cuyano Hot.—These sulphuretted springs are located in the cañon and valley of Cuyano.

Las Cruces Hot.—These sulphur springs are 42 miles from the city of Santa Barbara. The waters are saline and sulphuretted; temperature, 90° F.

Montecito Hot.—These springs are 5 miles from the city of Santa Barbara. The waters are sulphuretted, and nearly all boiling hot. A resort is being erected for the treatment of invalids, and suitable bathing facilities provided.

Mountain Glen Hot.—These sulphuretted springs (temperature, 60° to 100° F.) are about 25 miles N. of Santa Barbara.

San Marcos.—These sulphur waters are 7 miles N.W. of Santa Barbara. They have a temperature of 120° F., and are used locally for skin diseases, etc.

SANTA CLARA COUNTY.

Alum Rock Springs.—These springs are in a romantic cañon with an unromantic name, "Penitentiary Cañon," about 7 miles N.E. of San José.

	Grains per U. S. Gallon.
Sodium chloride	10.21
Sodium carbonate	7.14
Potassium carbonate	.76
Magnesium carbonate	8.92
Magnesium sulphate	7.16
Calcium carbonate	19.05
Magnesium carbonate	Trace.
Ferrous carbonate	Trace.
Alumina	6.45
Silica	2.52
Total solids	62.21

Free carbonic acid gas in excess.

Pacific Congress.—These mineral springs are in the Coast Range Mountains, about 12 miles S.W. of San José. They are so named from the similarity which exists between the waters of these springs and those of the noted Congress Springs at Saratoga, New York.

	Dr. Winslow Anderson, Analyst.	Bauer or Thayer, Analyst.
	Grains per U. S. Gal.	Grains per U. S. Gal.
Sodium chloride	115.76	119.15
Sodium carbonate	120.42	123.35
Sodium sulphate	12.95	12.14
Potassium carbonate	2.06	----
Magnesium carbonate	26.34	----
Magnesium sulphate	14.17	----
Calcium carbonate	16.03	17.29
Calcium sulphate	14.19	----
Ferrous carbonate	13.87	14.03
Alumina	4.50	----
Silica, alumina, and magnesia	----	49.98
Silica	3.98	----
Organic matter	Trace.	----
Total solids	334.27	335.94
Free carbonic acid gas	44.17 cu. in.	Cu. in. not determined.

SHASTA COUNTY.

Castle Rock.—These springs are near the foot of Mount Shasta. The waters are sulphuretted and carbonated soda. Locally they are used for rheumatic troubles.

Chalybeate.—On Bear Creek, N.W. of Fort Creek, near the head of Falls River, are several springs, highly carbonated and containing considerable ferrous carbonate. They are very pleasant to the taste.

Hibbs' Soda.—They are located 62 miles N. of Redding. The water is sparkling and pleasant; the chief mineral ingredient is sodium carbonate.

Lower Soda.—They are opposite the mouth of Castle Creek. The waters are alkaline and carbonated, and contain considerable amounts of iron carbonate.

SIERRA COUNTY.

Campbell's Hot.—They are one mile from the town of Sierraville. There are three springs, one cold, the other two hot; temperature, 104° F. The waters are slightly saline and mildly sulphuretted. There is good fishing and hunting in the immediate neighborhood.

SISKIYOU COUNTY.

Carbonated.—They are located on Shovel Creek road, in the northern part of the county. They have an agreeable soda taste, and are much used locally.

Frey's Soda.—These springs lie near the line between Shasta and Siskiyou counties. The waters are alkaline and carbonated. Temperature, 52° F.

Klamath Hot.—They are in the wild and picturesque country of the Mount Shasta region; altitude, 2,700 ft. With snow-capped mountain peaks and hills clad in evergreen forest groves, the saline sulphuretted springs have become as much noted for the surrounding scenery as for the therapeutic properties of the waters. They are 18 miles from Ager.

SOLANO COUNTY.

Tolenas.—These are located about 5 miles N. of Suisun, adjoining the Tolenas "onyx" quarries. Altitude, 1,235 ft.

	Dr. Winslow Anderson, Analyst.	J. Hewston, Jr., M.D., Analyst.
	Grains per U. S. Gal.	Grains per U. S. Gal.
Sodium chloride	194.16	215.92
Sodium carbonate	46.93	53.36
Sodium bicarbonate	6.45	----
Sodium biborate	19.13	20.56
Potassium chloride	6.47	5.68
Potassium iodide	1.75	2.08
Magnesium carbonate	11.58	10.88
Calcium carbonate	49.80	48.32
Ferrous carbonate	.89	.64
Alumina	1.10	.96
Silica	1.92	1.60
Organic matter	Trace.	Trace.
Total solids	340.18	360.00
Free carbonic acid gas	31.27 cu. in.	33.73 cu. in.

Vallejo Sulphur.—Near Vallejo are several sulphur springs, which are used considerably locally. The temperature ranges from 80° to 90° F. The waters act well on torpid portal circulation.

SONOMA COUNTY.

Agua Caliente Thermal Mineral Springs.—They are fully described in our XIth Report, p. 458.

Agua Rica Springs.—They are near Verano, on the Donahue Railroad. There are five principal springs. Analyses by John T. Evans, chemist:

	No. 1.	No. 2.
Potassium sulphate	.345	.492
Potassium chloride	.701	.....
Sodium chloride	34.961	.577
Sodium carbonate	1.785	.620
Lithium carbonate	Traces.	Traces.
Calcium carbonate	2.771	2.102
Magnesium carbonate	.175	1.216
Ferrous carbonate	.066	.....
Silica	6.014	6.399
Boracic acid	Traces.	Traces.
Sulphuretted hydrogen	.088	Traces.
Crenic and other organic acids	.169	Traces.
Total solids	47.075	11.500

Results are expressed in grains per U. S. gallon. The silica is present in the water in the free hydrated state.

Burns' Springs.—They are situated among the picturesque hills 3½ miles E. of Glen Ellen, and are all of icy coldness. One of these springs contains a large amount of iron, clearly shown in the deposits about the spring. An attractive summer home is being erected near the springs by Owen Burns, the owner.

Geysers.—See our VIIIth Report, p. 636.

Litton Springs.—See our VIIIth Report, p. 634.

Mark West Springs.—See our VIIIth Report, p. 634.

Skaggs Springs.—See our VIIIth Report, p. 634.

TEHAMA COUNTY.

Tuscan or Lick Springs.—These springs are located about 9 miles N.W. of Red Bluff, on the Sacramento River, in Tehama County. They lie in the center of a rough and rugged country showing signs of extinct volcanic action, at an elevation of about 600 ft. In this volcanic region of Tuscan are upwards of one hundred springs. Three only are in active use, and are known as the Red Spring, the White Spring, and the Black Spring. The Red Spring was analyzed by Dr. F. W. Hatch several years ago, and resembles somewhat the famous Blue Lick Springs, of Kentucky.

NATURAL GAS.

Natural gas is a mineral product which is found in all the bituminous formations of California, but it has attracted the most attention in the Sacramento and San Joaquin valleys, where public interest has been aroused by the practical use which has been made of natural gas at the city of Stockton.

Fuel Values of Natural Gas.—A series of experiments were made by the State Mining Bureau to determine the fuel value of the natural gas in the Central Valley of California, and, taking coke carrying 10 per cent of ash as a standard of comparison, in round figures, the following results were obtained:

1,000 cu. ft. of average Stockton gas	= 50 lbs. of coke
1,000 cu. ft. of gas from old well at Sacramento	= 34 lbs. of coke
1,000 cu. ft. of gas from spring on the Barker ranch	= 58 lbs. of coke
1,000 cu. ft. of gas from well, Sunset Oil District, Kern County	= 53 lbs. of coke

It will be observed that the value of the natural gas to consumers, as represented by the saving effected by its use, is greatly in excess of the value expressed by the calorific equivalents of the gas. This has been the experience in the Eastern States, as referred to in our Bulletin No. 3 on the "Gas and Petroleum Yielding Formations of the Central Valley of California." Nevertheless, the comparative calorific value of hydrocarbon gases is the most reliable basis on which to estimate their relative worth.

A line of inquiry was conducted by our department to determine whether the occurrence of natural gas in valuable quantities at Stockton is peculiar to that locality, or whether it is probable that a similar supply may be obtained by boring in other portions of the Central Valley of California. This necessitated a comparison of the geological conditions under which the natural gas is found at Stockton, with what may reasonably be supposed to be the geological conditions prevailing throughout the Sacramento and San Joaquin valleys. Investigation leads to the conclusion that the principal source of the gas in the Sacramento Valley are the Cretaceous rocks. In the San Joaquin Valley there are bituminous rocks of both Cretaceous and Tertiary age which yield inflammable gas. An examination of the records of the wells which have been bored in the valley lands, as given in our VIIIth, Xth, and XIth Reports and Bulletin No. 3, demonstrates that the natural gas is stored in porous strata which are geologically more recent than the bituminous formations above referred to. These gas-holding porous strata underlie sheets of clay which are first encountered at no great depth beneath the surface throughout the Central Valley of California. It is also probable that any organic remains which have been subjected to the necessary chemical change beneath the clayey strata of the valley have contributed to the gas stored in the adjacent porous formation.

It has been shown in our Bulletin No. 3 that the porous formations suitable for storing gas and oil, and which probably underlie the San Joaquin Valley, are several thousand feet thick. There has not been sufficient evidence to determine the area throughout which these porous strata extend, but investigation warrants a belief that they are coextensive with the central portion of the valley, and that the alluvial formations on the sides of the valley are either connected with the gas-yielding

rocks or isolated therefrom, according as the intervening strata are composed of either sand or clay. The researches of our department in this connection lead to the conclusion that the conditions prevailing in the San Joaquin Valley are somewhat more favorable than they are in the Sacramento Valley, for the showing of hydrocarbons in the Cretaceous rocks of the Sacramento Valley is much less than it is collectively in the Cretaceous and Tertiary rocks of the San Joaquin. An examination of the records of the Stockton gas wells shows that the average thickness of gas-yielding strata for wells 1,600 to 1,700 ft. deep may be put down approximately at 150 ft. Below that depth the proportion of gas-yielding strata greatly increases; and it is the opinion of those who have bored deeper wells at Stockton that below a depth of 1,700 ft. all the porous strata yield gas.

Concerning the tension of the gas, the problem is complicated by the presence of flowing water, which has been struck in nearly all the gas wells hitherto bored in the valley lands. There is no doubt that if the water could be kept out of the casing without impeding the flow of gas, the amount of gas yielded by the wells would be greatly increased. It is quite likely also that if the water could be excluded the quality of the gas would be improved, for the principal dilutant of the gas appears to be nitrogen, which in all probability is largely derived from air which is drawn down with the water when it sinks into the ground at the head of the artesian system.

It is a reasonable conclusion that other cities in the San Joaquin Valley besides Stockton may obtain natural gas in valuable quantities by boring wells of less than 3,000 ft. in depth. It is to be hoped that the subject of natural gas will be further investigated by boring in the Sacramento Valley, where appearances indicate that in some places sufficient gas might be obtained to be of practical value if it could be used on the spot.

The gas-yielding formations of the San Joaquin and Sacramento valleys are in proximity to the mines of the Sierra, to beds of pottery clay, and to sand suitable for the manufacture of glass. The localities where the principal gas wells are situated, or may yet be bored, possess water communication with the harbor of San Francisco. It needs no stretch of imagination to appreciate the fact that natural gas is an important factor in the geological economics of the Central Valley of California.

HUMBOLDT COUNTY.

Humboldt Land and Oil Company's Well.—During the summer of 1893 another well was sunk in the Upper Mattole country, in T. 4 S., R. 2 E. Finding the oil sand at a depth of 800 ft. poor in oil, the hole was capped and work stopped for the present. The formation passed through was gray shale, with an occasional seam of harder clay rock. Casing used was 7⅛ and 5⅝ in. to a depth of 695 ft., where the oil sand was struck; beyond that no casing was put in. At a depth of 135 ft. some gas came up, but was piped off; at 700 ft. a strong flow of gas was struck, sufficient to furnish light and fuel for the drilling plant. Some distance east of the well the oil sand crops out and shows 20 ft. of coarse gray sand impregnated with oil. It dips 60° N.E.

SACRAMENTO COUNTY.

Sacramento Natural Gas and Water Company.—This company have bored two wells in the southwestern part of the city of Sacramento. The well which was first bored is 876 ft. deep. The formation penetrated is alternate strata of clay, gravel, and cement, and quicksand; the lower portion of the formation being a hard, porous, sandy cement. Flowing water was struck in coarse sand at a depth of 281 ft., and a slight showing of gas was observed at 392 ft. The flow of water and gas increased with the depth. Operations were suspended, owing to an accident to the casing, at the depth of 866 ft. It is roughly estimated that the flow of gas from this well exceeded 2,000 ft. in twenty-four hours. In March, 1892, a second well was commenced about 150 ft. eastward from the first gas well. In May, 1893, this well had been bored to a depth of 965 ft., but the boring was suspended, owing to difficulty resulting from a sand pump having become fast at the bottom of the casing. The well-borers state that many of the strata penetrated by this well were very hard and required reaming; also that the greatest trouble resulted from the sand packing around the casing when it was standing on a hard stratum during the process of reaming. This well yields flowing water and inflammable gas. The officers of the company state that efforts are being made to recover the tools lost in the second well.

SAN JOAQUIN COUNTY.

In Stockton and vicinity there are more than twenty wells which yield natural gas in sufficient quantities to be of commercial value. Indeed, for the last five years it has been an established fact that at Stockton, by boring to a depth of something less than 2,500 ft., sufficient gas can be obtained to materially reduce the fuel bill of a large factory, or to supply a group of families with light and fuel. The following gas wells have recently been completed at Stockton:

Asylum Well No. 3.—This was commenced in 1892, and was bored to a depth of 1,992 ft., when work was suspended. This well is cased with 15 in. casing, No. 14 iron, to a depth of 854 ft.; thence to a depth of 1,422 ft. with 13½ in. casing; thence to 1,671 ft. with 12 in. casing; thence to 1,775 ft. with 10½ in. casing; thence to 1,780 ft. with 8 in. casing; thence to 1,786 ft. with 7 in. casing; thence to 1,979 ft. with 6 in. casing.

Central Gas Well.—This is situated at the corner of Miner Avenue and American Street. It is owned by a private company, who obtain their supply of gas for fuel and lighting from this well. In 1893, a depth of about 1,500 feet was reached, but tools were lost in the well, and as sufficient gas had been obtained to supply the parties interested, it was determined not to incur the expense of recovering the tools. The well was capped and the gas turned into a main, from which the parties using the gas are supplied. This well is cased with 13 in. casing to a depth of 800 ft.; thence to a depth of 1,100 ft. with 11 in. casing; thence to 1,150 ft. with 9 in. casing; thence to 1,500 ft. with 6 in. casing.

Grant Street Well.—Operations were suspended on this well in November, 1893, in order that the gas might be used by the Stockton Natural Gas Company, who own the well, and who require an accession to their supply of natural gas during the winter.

Cost and Yield of Stockton Gas Wells.—The following table will give some idea of the cost of boring and value of the Stockton gas wells. The volume of gas yielded by the Asylum wells was estimated by a field assistant of this department, who noted the time required to fill the gasometer at the Asylum wells, at a time when it was said that no gas was being used from this source. The other data relating to the wells mentioned in the following table are obtained from estimates made by the owners or parties in charge of the wells:

Name of Well.	Yield of Gas in 24 Hours, in Cubic Feet.	Cost of Well and Plant.	Depth of Well, in Feet.	Monthly Saving Effected by use of Gas.	Owners, and Remarks.
Asylum Well No. 1			1,750		
Asylum Well No. 2	34,000		1,992	$500	
Court-House Well	30,000	$12,000	1,917	300	
St. Agnes Well No. 1			960		
St. Agnes Well No. 2	20,000	10,000	1,720	100	
Jackson Well No. 1	16,700		1,655		Gas sold to Stockton Gas Light and Heat Co.
Jackson Well No. 2	14,000	12,000	1,400		
Haas Well No. 1	80,000		*3,000		Stockton Natural Gas Co., whose rates are $1 per 1,000 ft. or less, and 50 cts. for each additional 1,000 ft. Payable weekly.
Haas Well No. 2	43,000		2,000		
The Citizen Well	50,000	26,000	2,061		Private company, whose rates are $1 per each 1,000 ft. up to 5,000, and 60 cts. per each 1,000 ft. in excess of 5,000 ft. Payable monthly.
The Central Well	19,400	15,000	1,500		Used by stockholders of the company.

* Reported to be nearly 3,000 feet.

SISKIYOU COUNTY.

Well on Prather Ranch.—In August, 1893, a well was commenced on the Prather ranch (owned by the Shasta Land and Cattle Company), near Montague, the object being to prospect for flowing water, gas, and oil. This experimental boring was undertaken by the Shasta Land and Development Company, of Oakland. The well-borer employed is C. W. Fox, who states as follows: "The formation penetrated consists principally of grayish sandstone interstratified with black sand and white quartz pebbles. At the depth of 88 ft., an auriferous cemented gravel was encountered, which is about 18 ft. in thickness. At 138 ft. a few fossil shells were brought up by the sand-pump. At 280 ft. about 4 miner's inches of fresh water flowed from the casing. At 400 ft. inflammable gas was struck, and it burned with a flame about 18 in. above the top of the casing. The gas increased as the well was bored deeper, and at a depth of about 1,300 ft. it burned with a flame about 7 ft. above the top of the casing. This well is 10 in. for the first 500 ft., then it was reduced to 8 in."

YOLO COUNTY.

Capay Valley.—Inflammable gas is said to have been discovered arising from a saline spring on the Evarts ranch.

PETROLEUM.

California now takes the place of fourth in rank among the States in the production of petroleum, and a careful review of the subject shows that petroleum is assuming an increased importance among the mineral resources of our State. The petroleum industry has already assumed large proportions in Los Angeles and Ventura counties, and it is prosecuted to a less extent in Santa Clara, Kern, and other counties. The recent discovery of new valuable oil territory in the city of Los Angeles has given a decided impetus to the business, and it is probable that careful and systematic investigation will make known other localities where oil may be obtained in valuable quantities.

FRESNO COUNTY.

There are two groups of oil claims in Fresno County. The first of these is about 3 miles W. from Coalinga, and the second is nearly 9 miles N. from the same village.

First Group.—In those claims nearest Coalinga there are practically no developments; the geological formation consists of Cretaceous rocks—in which the coal mines of Coalinga are situated—overlaid, in places, by Tertiary strata, which also constitute the first tier of foothills.

Second Group.—The claims here cover an area of about 12 square miles. Two oil-bearing formations are exposed, namely: a light-colored silicious shale, belonging to the Miocene group, which yields an oil of high specific gravity; and dark-colored shales and soft sandstone, belonging to the Cretaceous system, from which an oil of low specific gravity is obtained. Five wells have been bored in the latter formation, and their depth varies from 163 to 650 ft.; three of them have been plugged. One of the open wells yields a small stream of weak brine and a little oil and gas. In the other an oil of low specific gravity stands within 32 ft. of the surface, and inflammable gas bubbles freely through the oil. Opinions differ as to the results attained by boring these wells. It is said that from one of them 10 bbls. of oil was pumped daily for two days, and that on the third day it yielded 7 bbls. of oil. Also that one of the wells, which is a 4 in. well and 400 ft. deep, yielded 9 bbls. of oil daily.

Samples of oil from this district were examined in the laboratory of the Mining Bureau, with the following results:

Oil from a Spring in the Light-colored Shales.

	Specific Gravity.
Crude oil	.988 about 12° B.
Below a temperature of 200° Centigrade a small amount of oil came over with water.	
Distillate below 250° Centigrade, 2.30 per cent.	
Distillate below 320° Centigrade, 6.20 per cent	.961 about 16° B.

Oil from a Well in the Dark-Colored Shales.

	Specific Gravity.
Crude oil	.852 about 34° B.
Distillate below 110° Centigrade, 0.60 per cent.	
Distillate below 150° Centigrade, 32.00 per cent	.799 about 45° B.
Distillate below 200° Centigrade, 27.60 per cent	.833 about 38° B.
Distillate below 250° Centigrade, 16.60 per cent	.875 about 30° B.
Distillate below 320° Centigrade, 12.00 per cent	.911 about 24° B.

The well from which this sample of oil was taken penetrates Cretaceous formations.

KERN COUNTY.

The principal oil-bearing formations are in the foothills of the Coast Range, in Buena Vista and Sunset oil districts.

Buena Vista Oil Company.—This company owns some 720 acres and have sunk four wells on their property, three being 92, 202, and 410 ft. deep. It is stated that the 92 ft. well yields 3 bbls. of heavy oil daily by bailing; also, that when the deepest well was only 392 ft. down 22 bbls. of heavy oil were pumped from it daily; but that when the casing was lowered to a greater depth the oil was shut off.

Sunset Oil Wells.—Here are two groups of oil wells; the *first* of these pierce a formation which is principally composed of light-colored silicious shale, and the *second* penetrate strata in which sandstone predominates.

In the *first group* there are twelve wells, varying from 80 to 500 ft. in depth, which yield altogether about 15 bbls. of heavy oil per day by pumping. The heavy oil is treated in a small refinery which has been erected at these wells by Messrs. Jewett & Blodget. The products of this refinery are heavy distillates and refined asphaltum, the latter being the residue from the process of distillation.

In the *second group* there are three wells. The first well bored is 820 ft. deep, and 6 bbls. of oil and 100 bbls. of brine are said to have been pumped from it daily for six months. The second well is of similar depth and yielded 4 bbls. of oil and 150 bbls. of sulphuretted brine daily. The third well is 1,320 ft. deep, and is said to yield more oil and brine than the other wells. A sample of the brine from this well was examined in the laboratory of the Mining Bureau, and found to contain 139 grammes of solid matter to the gallon, 118 grammes of which were sodium chloride (common salt) and 0.075 gramme iodine. The presence of an unusually large amount of iodine appears to be a characteristic feature of water from the oil-bearing formations on the eastern side of the Coast Range.

There are other wells in the Sunset Oil District which yield brine and a small amount of oil, but they have been abandoned. Nearly all of the oil wells in the Sunset District yield inflammable gas.

Samples of oil from the Sunset Oil District were examined in the laboratory of the Mining Bureau, and they showed as follows:

Sample of Oil from Oil Well No. 8, Group 2, Sec. 28.

	Specific Gravity.
Crude oil	.956 about 17° B.
Distillate below 250° Centigrade, 0.60 per cent.	
Distillate below 320° Centigrade, 48.33 per cent	.876 about 30° B.

Sample of Oil from Oil Wells, Group 1.

	Specific Gravity.
Crude oil (maltha)	1.01 about 10° B.
Distillate below 250° Centigrade, 0.60 per cent.	
Distillate below 320° Centigrade, 40.00 per cent	.881 about 29° B.

This sample was obtained from a tank which was said to be filled with a mixture of oils from Oil Wells, Group 1.

Sample of Oil from Well near Flowing Well, Sec. 13, T. 11 N., R. 24 W., M. D. M.

	Specific Gravity
Crude oil	.966 about 15° B.
Distillate below 200° Centigrade, 0.60 per cent	.840 about 37° B.
Distillate below 250° Centigrade, 5.00 per cent	.845 about 36° B.
Distillate below 300° Centigrade, 8.60 per cent	.870 about 31° B.
Distillate below 320° Centigrade, 5.20 per cent	.875 about 30° B.

More details concerning the occurrence of oil in this county will be found in Bulletin No. 3 of this Bureau, on "The Gas and Petroleum Yielding Formations of the Central Valley of California."

LOS ANGELES COUNTY.

The oil field lying E. of Newhall has been exhaustively described in our Xth Report, p. 283. Subsequent developments E. of Newhall and elsewhere about the region are of such a character as to indicate that the oil field is of much greater extent than was formerly believed. Indeed, it would seem strange if the narrow confines of Pico and Tousley cañons, with their folded and fractured strata, embraced all the oil-bearing formation in this portion of the State. Oil is being pumped from wells 10 miles E. from Pico Cañon, in Ventura County; in the city of Los Angeles; Puente, 20 miles E. of Los Angeles, and the indications are that a very extensive oil field has been penetrated in a few places. The Santa Clara Valley, north of Pico Cañon, and the San Bernardino Valley, south, each offer opportunities to those having capital and confidence in such an enterprise as sinking wells for oil in an untried field. There are thirty-seven wells in the Pico and Tousley districts, which are producing large quantities of oil. The actual production is not made public. The Tertiary formations in which the oil occurs has an extensive development in this part of the State, and it is reasonable to presume that oil may be found in paying quantities in the valleys above mentioned and also on the south side of the San Gabriel Valley, between Pasadena and Puente.

Banner Oil Well.—It is in Mud Springs Cañon, E. of the Golden West. This well is 800 ft. deep. When the well was first bored it yielded 125 bbls. of oil in eight hours, but water and quicksands broke into the well and ruined it.

Bayer & Bentz Well.—This is on Toluca Street, a short distance W. of the Thomas Wells. This is a 9½ in. well, and is 1,000 ft. deep, and yields 25 bbls. of oil daily by pumping. The formation penetrated by the Los Angeles wells is said to be a sandy shale, traversed by thin strata of sand and a few "shells" of silicious or calcareous rock.

Doheny Wells.—They are on Douglas Avenue, between West State and Court Streets. Six of these are 6 in. wells and about 600 ft. deep. About 10 bbls. of oil are pumped from each of these wells daily. The Doheny Company also own four 9 in. wells, which vary from 250 to 400 ft. in depth. These four wells yield about 10 bbls. of oil daily.

Ellsworth & Griggs Wells.—There are four of them E. of the Doheny Company. Three of them are 10 in. wells, 500, 700, and 675 ft. deep, yielding 25 bbls. of oil daily by pumping. The other well is 8 in. and was 675 ft. deep in July, 1894; it was then being bored to a greater depth.

Golden West Oil Well.—It is in Mud Springs Cañon, about 2 miles E. of Newhall. This well is 930 ft. deep. Oil was struck at a depth of 910

ft., but although there was a good showing of oil, it could not be profitably pumped on account of quicksand.

Los Angeles Oil Wells.—For many years a small deposit of brea was known to exist on West State Street, near Douglas Street, in the city of Los Angeles; and the brea was used locally for fuel. In 1892, at the corner of Paton and State Streets, not far from the deposit of brea before mentioned, a shaft 4 by 6 ft. and 155 ft. deep was sunk. The formation penetrated was sandy shale, with a few thin strata of sand and hard silicious rock. Near the surface the oil was a maltha, but at a depth of about 7 ft. the oil was lighter and seeped from the sides of the shaft. The most oil exuded from the most porous material, and it flowed readily from the surface planes of the hard silicious strata. The formation dipped S. 40°. At a depth of 155 ft. so much gas was encountered that further excavation was prevented. An 18 in. hole was then drilled in the bottom of the shaft and yielded 7 bbls. of oil daily for several weeks; in July, 1894, the yield had decreased to 2 bbls. of oil a day. In November, 1892, the first oil well was sunk at Los Angeles, on the north side of West State Street, between Paton and Douglas Streets.

C. E. Shaw, chemist to the Turner Oil Company, states that the oil yielded by the Los Angeles wells is a natural lubricating oil of a dark green color, and that an analysis of an average sample shows as follows:

	Per Cent.
First distillate, 48° to 26° B.	25.0
Lubricating oil, 26° to 18° B.	62.5
Asphaltic residue	12.5
Total	100.0

Pico Oil Wells.—They are in Pico Cañon, all within a distance of about 7 miles of Newhall, on the S. P. R. R., and are situated as follows: In Pico Cañon there are thirty-six producing wells, which vary from 600 to 735 ft. in depth. In Wiley Cañon there is a 600 ft. well, and in Elsmere Cañon there is a 600 ft. well. The oil yielded by this group of wells is conveyed by a pipe-line to Newhall. About 40 men are employed at the Pico Oil Wells. See our VIIth Report, p. 39; also Xth Report, p. 283.

Puente Oil Wells.—These are about 20 miles E. of Los Angeles. There are twenty-five producing wells, which vary in depth from 1,000 to 1,200 ft. The oil is conveyed by a pipe-line, 6 miles in length, from the oil wells to Puente, on the S. P. R. R. In July, 1894, the Puente Oil Company were laying a pipe-line between their oil wells and Los Angeles.

San Bernardino Oil Well.—This is in Placerita Cañon, 4 miles from Newhall. This well is 640 ft. deep; a set of tools was lost in it.

Thomas Wells.—These two wells are a short distance S.E. of the Doheny Company. Some of the wells are 6 in. and others 8 in.; they vary from 475 to 625 ft. in depth. The principal oil-bearing stratum is struck at a depth of about 600 feet, or at a somewhat less depth in the most western of these wells. About 50 bbls. of oil are pumped from these wells daily.

Washington Oil Wells.—They are in Tousley Cañon, about 3½ miles W. of Newhall. The oil territory owned by this company embraces about 1,000 acres. In July, 1894, the Washington Oil Company had two wells, 200 and 400 ft. deep, producing a black oil, and were boring a well which was then about 600 ft. in depth. It is said that a dark green oil was struck in the last-mentioned well. Six men are employed.

MONTEREY COUNTY.

Cholame Valley Oil Company's Well.—The well sunk by this company 2 miles N.E. of Parkfield was not a success. The strata passed through were unaltered sandstones to a depth of 800 ft. Just above the well are several small tar springs, issuing from soft sandstones. The well was bored in a little valley 400 ft. above the main Cholame Valley, at the base of Table Mountain. It is probable that the sandstones are not much disturbed, and the fact that tar seeps out of the side of the mountain was not a sufficient reason for boring a well at that point. It was very doubtful whether oil exists in paying quantities in this part of Cholame Valley. This section is described in our VIIth Report, p. 87.

SAN BENITO COUNTY.

San Carlos Oil Company's Well.—Nothing has been done here since our XIth Report was published. The oil well of this company is situated in the center of what appears to be a promising field. Oil-bearing shales and sandstones extend for nearly 10 miles along the southeast side of Vallecitos Valley, and over the divide toward Grizzly Cañon. Seven wells have been sunk along this belt, but with one exception they are very shallow, and though the indications are good, nothing is being produced at present. Seepages of oil, it is said, were found in all of them. The San Carlos well reached a depth of 160 ft., and from all that can be learned a considerable amount of oil was found here, but for some unknown reason the company is letting it lie idle. The formation is probably Miocene, lying quite flat in the valley, where it consists of blue clay rich in gypsum, while on the south and west and lower in the series there are bituminous shales and soft, porous sandstones, dipping away from the higher ridge of older rocks at a high angle or folded against it. Small tar springs are to be found in several places. It is definitely known that oil of an excellent quality exists here, and what is needed now are several test wells which would demonstrate whether it is present in paying quantities. Vallecitos District was described in our XIth Report, p. 372.

SAN LUIS OBISPO COUNTY.

Abandoned Well.—Six miles east of Cambria, on the western slope of the Santa Lucia Mountains, an oil well has recently been put down to a depth of nearly 700 ft. Nothing was found and the well was abandoned. A poorer place for an oil well could hardly have been selected, and though the formation through which the well was bored is the oil-bearing one in Southern California, yet it seems that no examination was made of the structure and extent of the formation. The Tertiary in this section, consisting of sandstones and light-colored bituminous slates, lies along the western slope of the Santa Lucia Mountains, in a long, narrow arm partly folded in between ridges of the older rocks, and at the point where the well was bored is quite narrow. It is broken up by several dikes, which extend in a parallel direction for several miles. It was apparent that in the course of only a few hundred feet the basement rocks must be struck, which it seems was the fact. At the point at which drilling ceased basic crystalline rock was met, one similar to that projecting through the strata on the surface.

SANTA BARBARA COUNTY.

Occidental Company's Wells.—The wells belonging to this company are 7 miles E. of Santa Barbara, on the southern slope of the Santa Ynez Mountains. Five wells have been bored, of which three are dry. No. 1 has produced 5,000 bbls. of heavy oil; at present it is producing 2½ bbls. daily. No. 2 was bored 625 ft.; dry. No. 3, abandoned. No. 4, down 425 ft.; abandoned. No. 5, 285 ft. deep; has produced about 500 bbls. of oil. The formation dips into the range at a high angle, forming, with a reversed dip higher up, a sort of synclinal. Numerous tar springs are found in the vicinity. Occidental Mining and Petroleum Company, owners.

Santa Monica Oil Company's Well.—The well of this company is located in a cañon of the Santa Ynez Mountains, north of Carpinteria. At 400 ft. depth a little oil was struck. The well is now down 700 ft. The gas pressure is very strong, forcing a stream of sulphurous water from the well. Liquid tar seeps up through the rocks along the cañon near the well through argillaceous strata, which dip 50° to 60° S. Heavy beds of sandstone alternate with the shale.

VENTURA COUNTY.

The petroleum interests of Ventura County are chiefly in the Santa Clara Valley.

Union Oil Company.—They have the most extensive business in the oil fields of Ventura County, as the following list of their various wells readily demonstrates:

	Depth.
9 wells in Santa Paula Cañon	150 to 800 ft.
29 wells in Adams Cañon	115 to 2,780 ft.
9 wells in Salt Marsh Cañon	500 to 1,500 ft.
5 wells in Wheeler Cañon	about 500 ft.
5 wells in Aliso Cañon	500 to 800 ft.
In Ojai Valley.	
11 wells in Sisi District	90 to 900 ft.
3 wells 1 mile S. of Nordhoff	500 to 800 ft.
In Sespe District.	
33 wells on Tar Creek	200 to 1,800 ft.
5 wells on Four Forks	1,500 to 1,760 ft.
7 wells in Los Angeles	600 to 900 ft.
6 wells in Kentuck	500 to 900 ft.
In Tory Cañon.	
16 wells in Bardsdale District	515 to 1,745 ft.
1 well on Calagua ranch, 9 miles S. of Hueneme	900 ft.

From 30 to 90 men are employed by the Union Oil Company in connection with their wells, the number of employés depending upon whether boring operations are being carried on. The oil is conveyed to their refinery at Santa Paula by pipe-lines. The plant consists of numerous iron tanks, having a total capacity of about 50,000 bbls.; three 100 bbl. fire stills and one 100 bbl. steam still, with condensers; two 150 bbl. agitators; one 100 bbl. lead-lined agitator; a press-house with filtering press, and compounding-house, with suitable tanks for heating with steam and air-blast; also a large apparatus for cooling asphaltum residues and filling barrels with asphaltum and oils; a cooper's shop, printing-ink factory, and boiler-house. From 10 to 20 men are employed in the refinery.

Fortuna Oil Company.—This company have six wells, varying from 115 to 450 ft. in depth, in Hopper Cañon. These wells produce about 30 bbls. of oil daily. From 5 to 8 men are employed.

Sisi Oil Company.—They own nine wells, varying from 320 to 800 ft. in depth, in Sisi Cañon. The yield of these wells is 1,200 bbls. a month. Ten men are employed.

Eureka Oil Company.—They own three wells, varying from 230 to 50[illegible] ft. in depth, in Limekiln Cañon. The yield of these wells is about 8[illegible] bbls. a month. From 2 to 3 men are employed.

Capitol (Elysian) Oil Company.—They own eleven producing wells, varying from 300 to 1,200 ft. in depth, which are in Sisi Cañon, and yield about 1,100 bbls. of oil a month. Also one well 1,200 ft. in depth in Bardsdale Cañon, yielding 60 bbls. of oil a month.

QUICKSILVER.

The total product of quicksilver in the United States from 1850 to the end of 1893 has been 1,646,537 flasks of 76½ lbs. each, net. All of this vast amount, with the exception of 65 flasks from Oregon, was produced by the mines in the State of California. The metal is found in many counties, but is now mined in Colusa, Lake, Napa, San Benito, Santa Clara, Sonoma, and Trinity. Though the annual production of the State has declined since the marked annual reduction of output of the largest producing mine—the New Almaden—the total yield is still upward of 3,000 flasks per annum. The New Almaden, which still continues to be the largest producer, though only yielding about half what it did four or five years ago, increased its yield in 1893 over that of the previous year by about one sixth. Of the total output of the State since 1850, noted above, this one mine produced 936,736 flasks.

ALAMEDA COUNTY.

Comstock Mines.—These are situated in Sec. 19, T. 11 S., R. 6 E., and have not been worked for many years. The old workings consist of open cuts with short tunnels running therefrom. A large mass of silicious vein matter is exposed, which in some places shows traces of cinnabar. The foot-wall is serpentine; the hanging-wall is not visible. The altitude of the mine is about 900 ft.

Vaughan Quicksilver Mine.—This is in Sec. 14, T. 11 S., R. 6 E., near the contact of the serpentine and sedimentary formations. Work was commenced at this mine in 1889, when an incline 70 ft. deep was sunk upon the vein, which dips in a N.E. direction. At the bottom of the incline a 50 ft. drift has been run to the N.W., all the way in silicious vein matter showing cinnabar. At the end of the lower drift a cross-cut shows the ore body to be 18 ft. in thickness. The foot-wall is serpentine and the hanging-wall clay. At the top of the incline the ledge crops out and shows cinnabar and native quicksilver. Two tunnels have been run in to strike the vein. One of these is about 160 ft. in length, and was commenced at a point which is about 50 ft. below and 170 ft. distant in a S.E. direction from the top of the incline. The second is about 380 ft. in length, and was commenced at a point which is about 150 ft. below and 400 ft. distant in a N.W. direction from the

top of the incline. In both of these tunnels silicious vein matter, which shows cinnabar, was struck.

COLUSA COUNTY.

Central Mine.—This is in the Sulphur Creek Mining District. In 1893, Mr. York, by way of experiment, concentrated some of the soft earthy ore from this mine, by washing it in sluice-boxes; he obtained about 10 tons of concentrated ore, assaying 7 per cent quicksilver. See our XIth Report, p. 185. Northey & York, of Sulphur Creek, owners.

Elgin Mine.—It is situated at Sulphur Creek. Development was prosecuted at this mine to some extent in 1893, and it was said that a large body of "furnace ore" was exposed; also that some rich ore was taken out and reduced in a small retort.

Farris (Oriental) Mine.—This is situated in the Sulphur Creek Mining District. Considerable work has been done, and about 200 tons of good furnace ore taken out. Judge Moore, of San José, owner.

Manzanita Mine.—This is on Sulphur Creek. During 1893–94 the work done on this mine has been principally development. The work of concentrating the low-grade ores, mentioned in our XIth Report, was suspended in 1893, owing to new machinery being required. The concentrates on hand were retorted, and the auriferous residues were saved for future treatment. See our XIth Report, pp. 184 and 185. Manzanita Gold Mining Company, of New York, owners; G. V. Northey, of Sulphur Creek, resident agent.

Rathburn Mines.—These mines are on "Dead Shot" ridge, which forms the western side of Bear Valley. During the winter of 1893–94 two retorts, which have a capacity of 600 lbs. every twelve hours, were in operation, and 150 flasks of quicksilver were produced. M. Rathburn states that a portion of the ore came from the Farris Mine, on Sulphur Creek. See also our XIth Report, p. 184. J. P. Rathburn et al., of Williams, owners.

Sulphur Creek Mining District.—The *Empire*, *Mercury*, and *Buckeye* quicksilver mines are also in this district. See our XIth Report, pp. 186 and 187.

EL DORADO COUNTY.

Cinnabar Mine.—This old mine is on the East Fork of Dry Creek, 7 miles S. of Shingle Springs and 3 miles N.W. of Yeomet. The developments consist of two tunnels and a shaft. The inclosing rock is slate, talcose near the vein. Judging from specimens on the dump, the cinnabar occurs impregnating a stratum of sandstone. A furnace formerly existed here, and it is reported that quite a number of flasks of quicksilver were produced. If this is a fact, this is the only mine in the Sierra Nevada which has produced quicksilver in commercial quantities.

Cinnabar has also been found in the hills west of Big Cañon and 5 miles S. of Shingle Springs. At one spot a short tunnel was run. Particles of cinnabar are quite abundant in the creek gravels in this vicinity.

GLENN COUNTY.

It is stated that a ledge of cinnabar-bearing rock has been discovered on the ranch of W. S. Nye, about 20 miles W. of Stony Ford.

A good "prospect" of cinnabar is also reported to have been found on the Turner ranch, about 6 miles W. of Elk Creek.

LAKE COUNTY.

Abbott Mine.—It is near the Colusa County line, at the head of Grizzly Creek, 22 miles from Lower Lake, and comprises 70 acres, with 760 acres of timber land. The ore, which is found in seams, in an earthy shale, courses N. of W. near the contact with the serpentine, and carries cinnabar, black metal, marcasite, and pyrites; the "alta"* is on the foot-wall, but the best ore is generally next to the hanging-wall. The mine is worked through tunnels, the main one, a quarter of a mile in length, runs north, cutting across to the hanging-wall, through 560 ft. of shale, striking the ore at a depth of 220 ft. below the surface. The principal ore shoot has been followed upward on a slope of about 30° for a continuous length of 600 ft. to an upper tunnel, without pinching out at either end, carrying a width of from 2 to 18 ft. of 2 per cent ore. The output with 8 men in the mine is 8 tons per day; this can be readily increased if required. On account of scarcity of timber, which costs 7 cents per foot, lagging 7 cents apiece, the ground is secured by filling the stopes with waste, and recovering the stulls for further use. There is a Knox & Osborne coarse-ore furnace of 10 tons capacity, with 6 small-sized iron condensers, and a blower run by a 20 ft. overshot wheel, which takes its water from the mine. The lime used is burnt on the ground. See our XIth Report, p. 239.

American Mine.—This is 7 miles W. of Middletown, on the same range as the Great Western. Here the cinnabar is found in the seams and in bunches in a silicious rock. Wright Bros., of Middletown, owners.

Baker Mine.—It is in Sec. 16, T. 12 N., R. 6 W., 5 miles E. of Lower Lake, and comprises 40 acres. The ore body has the same course as the Knoxville and Manhattan, between sandstone and serpentine, the former being the hanging-wall, and the "alta" forming on the serpentine. Cinnabar with some cinnabarite and marcasite is found next to and also in the sandstone. The outcrop is indicated by a series of mineral springs; one of these is a boiling, the others cold soda and chalybeate springs. There are two seams pitching at an angle of 30°. The ore is reported as yielding 0.75 per cent of metal; the marcasite is slightly auriferous. Developments consist of a 700 ft. tunnel driven on the ore body, besides a 100 ft. shaft with a 40 ft. drift running to the under seam and beyond, but not reaching the upper seam. See our XIth Report, p. 66. J. C. Baker, of Lower Lake, owner.

Bullion Mine.—It is 4 miles S.W. of Middletown, and comprises 1,500 by 600 ft. The croppings of the ore body, 30 ft. in width, course N. 25° W., and dip about 50° S.W. Developments consist of a 60 ft. shaft and cross-cuts run to the fissures from the bottom, about 20 ft. long. A small retort is used for prospecting.

*"Alta" (a Spanish term) is a layer of attrition products, so-called clays, full of slickensides and of fragments of rocks more or less rounded by attrition; it is followed by the miners in their search for ore.—*Becker.*

Destinelle Mine.—It is an east extension of the Abbott, and comprises three claims extending into Colusa County. Developments consist of four tunnels. See our XIth Report, p. 239.

Great Western Mine.—It is 4 miles S.W. of Middletown, and comprises 6,000 by 600 ft. The ore body ranges nearly E. and W., with a curving dip first to the N. for a depth of 350 ft., then S. The ore body consists of masses of ore extending from the black hanging-wall to the sandstone foot-wall, the latter becoming highly metamorphosed in depth to an extremely hard quartzite. The hanging-wall gradually approaches the foot-wall, pinching the ore, which, however, forms again behind. Black opaline rocks form the croppings. The cinnabar is found next to the sandstone, and in some parts of the mine there is native mercury. The workings are carried on through a double-compartment shaft 350 ft. deep, from which a drift 800 ft. connects with a second shaft, where the hoisting is done by compressed air. The ore is hoisted through the shafts, while the waste is trammed through a tunnel 500 ft. below the collar of the shaft. On account of the heavy pressure of the ground, the working drifts are run in the foot-wall parallel to the ore deposit, as otherwise connections could not be maintained. The stopes, which are from 15 to 200 ft. wide, are timbered with extremely heavy square sets (2 to 3 ft. timbers), as used on the Comstock, and these are frequently crushed. In some of the hot stopes stalactites of iron sulphate form. The ore averages 0.75 per cent of metal, and the present output is 70 tons per day. There are two furnaces, for coarse and fine ore, which consume 10 cords of wood per day, costing $3 25 per cord. The yield for 1893 was 3,250 flasks, as against 6,000 flasks the previous year, the decrease being due to the hot, bad air in the stopes. See our VIIIth Report, p. 325; also XIth Report, p. 64. Great Western Quicksilver Mining Company, owners; A. Rocca, of Calistoga, Superintendent.

Standard (Mirabel) Mine.—This is 13 miles N. of Calistoga, in part of Secs. 14, 23, 22, 26, 27, T. 10 N., R. 7 W., and comprises 1,200 acres. The course of the ore deposit is to the N.W., with a dip of 40° E., and is in the nature of a fissure or pipe vein, between serpentine and sandstone, with "alta" on the hanging-wall. The two veins on the surface unite at 300 ft. in depth. The ore is opaline, carrying cinnabar and free mercury. Developments are carried on in the mine through a double-compartment shaft 400 ft. deep, with drifts every 100 ft., extending out 400 ft. from the shaft. A stope on the 300 ft. level is 250 ft. long, 50 to 60 ft. wide, and timbered with square sets. The pay shoot has been drifted on 600 ft. Two furnaces are employed; the coarse-ore furnace has a capacity of 15 tons per day, and the fine-ore of 30 tons; the ore averaging 1¼ per cent of metal. Last year's output was 5,151 flasks. Timbers cost $16 per thousand feet, board measure. Freight is $6 per ton, and wages $2 per day. Present force is 50 men. See our XIth Report (Bradford Mine), p. 64. Standard Quicksilver Mining Company, owners; — Randol, of Middletown, Superintendent.

Sulphur Banks Mine.—This is on the southeastern end of Clear Lake, and comprises 40 acres, besides some land near Burns Valley, where the company have two limekilns. The old works have been abandoned and a prospect shaft has been sunk 149 ft. in new ground, and is supplied with steam hoisting works, large blowers, and a No. 5 Hooker pump. The water hoisted from the shaft has a temperature of 135° F. The furnaces are not working; five retorts are used cleaning up. Fifteen men

are employed. See our VIIth Report, p. 324. Sulphur Banks Quicksilver Mining Company, owners; R. White, of Lower Lake, Superintendent.

Uncle Sam Mine.—It is 10 miles N.W. of Lower Lake, near Konocti Mountain, and comprises three claims. It is a mere prospect; the indications show low-grade ore, and extend over a width of about 400 ft. in serpentine. A. A. Gibson, of Lower Lake, owner.

Utopia Mine (Quicksilver).—This is on the east side of Clear Lake, opposite Lakeport, near Bartlett Landing, and comprises one claim; it is undeveloped. L. Boggs, of Lakeport, owner.

Wall Street (Jewess) Mine.—It is 6 miles W. of Middletown. Not working. The opaline rock carries cinnabar and native mercury.

MONTEREY COUNTY.

Murray Quicksilver Mine.—It is on one of the northern branches of San Carpojoro Creek, about 2 miles from the ocean. A small furnace was erected here and some quicksilver produced, but work has ceased.

NAPA COUNTY.

Ætna Mine—This is in Secs. 2, 3, and 4, T. 9 N., R. 6 W., 1 mile N. from Lidell, at an altitude of 1,200 ft. It comprises the Old Phœnix Mine, Washington, Silver Bow, Red Hill, Pope, and Star claims. The rock which carries the ore in the Phœnix is a black chalcedony and silicious slate, through which run stringers of cinnabar. The ore occurs in a fissure system, but with some impregnations in places. Most of the present developments are being made in the Star, Silver Bow, and Red Hill ground. In connection with the cinnabar are marcasite, pyrite, native mercury, and a peculiar bituminous substance named by Dr. Becker "napalite." In his monograph, "Geology of the Quicksilver Deposits of the Pacific Slope," he gives the following analyses made on three samples:

	Carbon.	Hydrogen.
Pure material from rock samples	89.84	10.17
Material dissolved in ether, filtered	89.54	10.36
Material fused at low temperature	89.35	10.11

In the Star and Silver Bow claims the ore occurs at the contact of basalt with the sandstone which it penetrates. In the Pope claim the cinnabar is found in a silicious shale.

This mine is at the S.E. end of a belt of serpentine extending N.W. for several miles, in which several other prominent quicksilver mines are located. The main workings are through a tunnel running in through serpentine and sandstone, to a body of argillite that crops out on the top of one of the hills; this tunnel is nearly three fourths of a mile long and 350 ft. below the surface. Two other tunnels are also being run. That on the Star claim is about 200 ft. deeper than the main tunnel (1,300 ft. long) and is run to cut a large chamber of ore in the Silver Bow claim. The third tunnel, running toward the argillite point, is 138 ft. lower than the main tunnel. The average cost for driving ground in these tunnels is about $2 25 per foot. In No. 2 tunnel the walls are slow swelling, but on the whole the mine does not require heavy timbering. The largest part of the present ore supply

comes from east of the main tunnel at the contact of the sandstone and argillite, the ore impregnating the sandstone. The mine has natural ventilation. The ore is taken from the mine by mule power, hauling four cars at a time, making nine trips per day.

Two furnaces are working, one on coarse and the other on fine ore. The former has a capacity of 22½ tons, the latter 15⅛ tons per day, giving a yield of 320 flasks per month, with a consumption of 2,500 cords of wood per year, costing $4 per cord, delivered. A National compressor runs a Phœnix National and an Ingersoll drill. Timbers cost 5½ cents per foot; freight, $4 per ton. About 100 men are employed, the majority Chinese. Whites receive $2 and Chinese $1 25 per day. See our XIth Report, p. 72. Ætna Mining Company, owners; B. M. Newcomb, of Lidell, Superintendent.

Harrison Mine.—It is in Sec. 36, T. 12 N., R. 5 W., 17 miles S.E. of Lower Lake, between the Manhattan Mine and Lower Lake, and comprises 40 acres. Two men are running a tunnel to the ore seam, now 300 ft. in and about 200 ft. below the surface. E. Harrison et al., of Knoxville P. O., owners.

Knoxville (Redington) Mine.—This is 20 miles W. of Capay Valley, at Brooks Station, in Secs. 5 and 6, T. 11 N., R. 4 W. The mine is on the range dividing Yolo and Napa counties, and comprises 160 acres of mineral land; the entire property includes several thousand acres. The ore body courses N.W., dipping 45° N.E., between serpentine and sandstone walls, the latter on the east. The width of the vein is from a seam to 75 ft.; in the present workings the ore body is from 15 to 20 ft. wide.

The old works, which extended to a depth of 600 ft., are closed for the present, and work is being carried on to the N.W., where a double-compartment shaft supplied with a steam hoist has been sunk 200 ft. The water is hoisted by a bucket. A tunnel from the surface connects with this shaft, also with the old workings. The mine is well ventilated. The ground is swelling; in the main drift and tunnel 7 ft. posts are used with caps 3½ ft. in the clear and 7 ft. spread. Posts and caps are used in the stopes, and the waste rock is filled in. The mine timbers are bought here by the cord, 100 cords of the timber being used per annum at $7 per cord; it has to be hauled from 3 to 10 miles. The Livermore patent fine-ore furnace consumes 1½ cords of firewood per day, at a cost of $5 per cord; the output is 25 tons per day of 0.75 per cent ore; 19 condensers are used. The output of quicksilver last year was 1,450 flasks. At the present time 35 men are employed, all white, who receive $40 and board per month. From the present working shaft a cross-cut extends 170 ft. to the ore body, there being two parallel seams 55 ft. apart pitching about the same (40°), but getting somewhat flatter in depth. The drift extends N. and S. on the seams, 150 ft. on the front and 175 ft. on the back seam. From the drift a winze has been sunk to the 300 ft. level, where there is a fine showing of first-class ore against the clay seam. A. McMillan, of Knoxville P. O., owner.

Lake (Manhattan) Mine.—This is 3 miles W. of Knoxville and 17 miles S.E. from Lower Lake, in T. 10 N., R. 4 W., and comprises fifteen claims. The ore belt has the same N.W. course as the Knoxville. The old works, 200 ft. deep, are not being worked; the present workings are carried on through a shaft 200 ft. deep sunk in the sandstone W. of the former works, with two levels 100 ft. apart, cross-cutting 170 ft. to the

ore seam. A stope 170 ft. long carries ore from 30 to 40 ft. wide, the cinnabar being in seams as well as impregnating the sandstone. There is no swelling ground in this mine, and ventilation is secured through an air shaft 150 ft. deep connecting with the drifts, the main shaft being an upcast. Two furnaces are used alternately, one for the coarse, and the other for the fine ore. None of the ore is crushed; all that passes through the grizzly goes through the fine-ore furnace, the rest to the coarse-ore furnace, which is started when sufficient material has accumulated. The output of these furnaces is 24 tons per day for the coarse furnace and 20 tons for the fine. Last year the furnaces ran three months, producing 400 flasks. The ore averages 1 per cent of mercury. The coarse-ore furnace consumes 1½ cords per day, costing $5 per cord, obtained from a distance of from 6 to 10 miles. Freight charges are ¾ cent per pound for three months and ½ cent for nine months. Lumber delivered from Lower Lake costs $28. Thirty-one men are employed, miners receiving $39 and laborers $30 per month (26 days) and board. The present output is given as 15 to 20 flasks per month. The sulphurets in this mine carry a little gold. The mine has produced 5,000 flasks. Lake Mining Company, owners; R. F. Knox, of San Francisco, Secretary.

Manhattan Mine.—See Lake.

Napa (Oat Hill) Consolidated Mine.—See our XIth Report, p. 65. It is 4 miles N. of Lidell, at the head of Pope Valley on James Creek, at an elevation of 2,000 ft., and comprises eighteen patented and four possessory claims. The present developments are all to the west of the former works, in a friable sandstone, and include thirteen tunnels driven on different contour levels; five of these are being worked. There are three tunnels on No. 1 contour level; three on No. 2; four on No. 3; one on No. 4. The Humboldt tunnel on No. 1 contour is 1,128 ft. long, of which the first 100 ft. are cross-cutting to seam No. 1; 400 ft. beyond is a second seam; the third seam is found 137 ft. farther, and a fourth one 850 ft. from the mouth of the tunnel. The Edna Maybell tunnel on No. 1 contour is 1,550 ft. in length, and the Osceola on the same level is 300 ft. long. The seams in the first two run at right angles to the bedding planes of the sandstone, while in the Osceola the ore seams are with the bedding planes. An intermediate tunnel between contours No. 1 and No. 2 is 913 ft. long. The ore supply comes mostly from No. 2 stope in the Humboldt tunnel and from the Osceola. The daily output is 50 tons. Last year's product was 60,000 flasks. Nearly 50,000 ft. of lumber are consumed per year. A 40 ft. modern shelf furnace reduces the ore. Napa Consolidated Mining Company, owners; B. M. Newcomb, of Lidell, Superintendent.

Oakville Mine.—It is 1½ miles S. from Rutherford, on the range of mountains forming the western boundary of Napa Valley. It contains an old furnace plant. The formation is silicious slate with serpentine in close proximity; the outcrop can be traced for nearly two miles in a N.W. and S.E. course, dipping W.; the ore carries cinnabar, with pyrite and calcite, forming in seams and benches connected by narrow stringers of ore. It is developed through several tunnels partly caved. Cross-cutting from the N. to the vein, considerable water was tapped, which still issues from the tunnels. The mine, though idle now, has yielded considerable quicksilver, and would pay to work whenever the price of quicksilver goes up. Oakville Mining Company, owners; — Jenkins, of Oakville, agent.

Oat Hill Mine.—See Napa Consolidated.
Old Phœnix Mine.—See Ætna.
Pope Mine.—See Ætna.
Redington Mine.—See Knoxville.
Red Hill Mine.—See Ætna.
Silver Bow Mine.—See Ætna.

Summit Mine.—It is 8 miles S. from St. Helena and 4 miles W. from Rutherford, near the Napa Valley Railroad, in Sec. 24, T. 6 N., R. 6 W., at the head of Dry Creek, and comprises 80 acres. The ore body outcrops plainly for 2,000 ft., about 60 ft. wide, coursing N.W. and S.E., and pitching about 70° E., between serpentine on the W. and sandstone on the E., with "alta" next to the hanging-wall, 10 to 12 ft. thick. The ore body shows calcite, silica, and cinnabar, with chromium stains. A part of the outcrop has been quarried, yielding ochery ore, said to have returned, after sorting, 9 per cent of metal. A tunnel cross-cutting through the serpentine for a point beneath the former surface workings has reached 250 ft., or about half the required distance; it is expected to reach the ore body about 300 ft. below the surface. Little timbering is required, and two men make 3½ ft. per day at wages of $1 and board; four men are employed. Timber is procured about 1½ miles away; fir being used. Cordwood, cut on the ground, costs $3 delivered. F. W. Keeny, of Rutherford P. O., Napa County, owner.

Washington Mine.—See Ætna.

SAN BENITO COUNTY.

These mines, in the northeast corner of the county, have not been worked for many years.

China Diggings.—These are situated upon the county line, in Sec. 20, T. 11 S., R. 7 E. On them are open cuts filled with talus from the Mariposa Peaks. The formation appears to be decomposed eruptive rock, permeated with silicious veinlets, some of which show traces of cinnabar. Altitude, about 2,300 ft. See our VIIIth, Xth, and XIth Reports, pp. 486, 515, and 371.

Mariposa Claim.—This crosses the southeastern extremity of the Santa Cruz claim, with which it conflicts on the surface. About 400 ft. N.E. of the principal workings of the Santa Cruz, and probably 100 ft. below them, a tunnel has been run 200 ft. into the mountain in a N.E. direction. In the end of the tunnel, and in a short drift at this point, there are numerous narrow seams of cinnabar mixed with material which resembles the wall rock. These seams dip S.W. The inclosing formation is a soft, white eruptive rock. See our VIIIth, Xth, and XIth Reports, pp. 486, 515, and 371.

New Idria Quicksilver Mines.—They have been thoroughly described in our VIIIth and XIth Reports, pp. 483 and 373. No new developments since. Thomas N. Williams, of New Idria, Superintendent.

San Benito Mining Company.—This company is operating on the Gypsy claim, near Staytonville, 15 miles N.E. of Hollister. A tunnel is being run to tap the ledge 200 ft. below the surface. The summit of the range on which the Staytonville mines occur is formed chiefly of a quartz-trachyte. The veins course N. and have a vertical position in the lava. Developments in this district have shown that the veins are small and are not generally profitable to work. See our Xth Report, p. 516. — Nikerson, of Hollister, Superintendent.

Santa Cruz Mine.—This adjoins the China Diggings on the east, in the same formation. In December, 1893, there was a small quantity of cinnabar ore on the dump. See our VIIIth, Xth, and XIth Reports. pp. 486, 515, and 371.

SAN FRANCISCO COUNTY.

In the early part of 1893, in excavating on the S.W. corner of McAllister and Devisadero Streets, cinnabar was discovered by the workmen. A shaft was sunk 18 ft. and several shallow trenches dug; the result was about 350 pounds of high-grade ore and a considerable quantity of low-grade material. Believing that the prospect would lead to nothing more valuable, mining operations were suspended. An examination of the locality proved the occurrence of the cinnabar at and near the contact of sandstone and serpentine. A broad belt of serpentine, with numerous branches, extends S.E. from Fort Scott across the city, passing through the Presidio Reservation, Laurel Hill Cemetery, and on toward the Potrero, being exposed at numerous places, notably in the Market Street cut. It is said cinnabar was found in grading McAllister Street some time prior to the discovery above noted. None of these prospects have been followed up, however, though the mineral occurs under conditions similar to those at many of the large mines of this State.

SAN LUIS OBISPO COUNTY.

Black Hawk Quicksilver Mine.—It is on the south bank of the San Carpojoro Creek, 3 miles from the ocean. Several tunnels have been run here, but no extensive body of ore encountered. Small specimens have been found that are very rich.

Oceanic Quicksilver Mine.—See our Xth Report, p. 580. No work has been done on it for years.

Pine Peak Quicksilver Mine.—See our Xth Report, p. 581. It is still idle.

Rinconada Quicksilver Mine.—It lies just south of the Santa Margarita grant. Here are seven claims, on which appear heavy croppings of red gossan. A large amount of work has been done here, as shown by the tunnels and open cuts. Many tons of fair quality of ore lie on the dumps. See our Xth Report, p. 581.

Santa Cruz Sunderland Quicksilver Mine.—It is on Las Tablas Creek, 1 mile N.W. of Adelaide P. O. Many tunnels and open cuts were run on the very extensive croppings years ago. The ore is contained in a gangue of the usual kind. The deepest of the old workings was not over 60 ft. Work is now progressing on a new tunnel to cut the main ledge over 100 ft. from the surface. At the time of our visit the tunnel was in 200 ft., and no traces of cinnabar were being encountered. See our Xth Report, p. 580.

SANTA BARBARA COUNTY.

Los Prietos and Santa Cruz Quicksilver Mines.—They are on the Santa Ynez River, north of Santa Barbara. The Santa Cruz lies farthest up the river. The old workings are situated on the south bank at an elevation of 600 ft. above the river. The croppings of mineralized serpentine are quite extensive.

The Los Prietos Mine is 4 miles below, on a similar body of gossan,

which crops in great cliffs on the river. The old works at both places are nearly rotted down, and nothing could be found out concerning the quality of the ore. See our VIIIth and Xth Reports, pp. 537 and 596.

SANTA CLARA COUNTY.

Bradford & Treadwell Mine.—It is on the east side of Silver Creek, near the North Almaden Mine. During 1893 a shaft was sunk here to a depth of 110 ft., the first 60 ft. passing through serpentine; washed gravel was then encountered, and continued to the bottom of the shaft. A drift 500 ft. in length was run east under the hill; every foot of the way was washed gravel. This unusual occurrence being deemed worthy of investigation, the writer visited the mine. A single glance at the hillside above the works served to show that a great landslide had occurred many years ago, but at a very recent geological period. An immense mass of serpentine over 1,000 ft. in length, and apparently 300 ft. wide, with a thickness of at least 60 ft., and possibly much more, had slipped down into the Silver Creek gulch, covering the deposit of gravel existing there at that time, and forcing the stream to cut a new channel farther to the west. Many detached masses of serpentine are found on the North Almaden ridge on the opposite side of the creek, which undoubtedly are due to this landslide. Further investigation showed that numerous smaller landslides had occurred along the hill in question, but none of them approaching in magnitude the one through which these miners had cut their shaft and tunnel. It may be that further prospecting on a deeper level, and at or near the contact of the sandstone and serpentine, may discover larger and more valuable deposits of cinnabar than have yet been found in this locality.

Comstock School District.—In the S.E. corner of Santa Clara County, quicksilver, chromic iron, antimony, and, it is said, gold have been found; but little could be learned of these occurrences, excepting that they are entirely undeveloped. This mineral section lies at the corner of Santa Clara, Merced, and San Benito counties. The region is difficult of access.

Guadaloupe.—See our VIIIth Report, p. 542. The mines have been idle for a number of years. Some prospecting done within the past year has resulted in the discovery of small quantities of cinnabar.

Hillsdale Mine.—Cinnabar occurs within half a mile of Hillsdale Station, on the Monterey branch of the S. P. R. R. Years ago the property was worked for a brief period.

Mariposa Creek.—Cinnabar prospects are said to occur here, but they have not been developed or even prospected.

North Almaden.—About 9 miles S.E. from San José are quicksilver deposits which were worked many years ago, but are now abandoned. The deposits occur in sandstone, but are small and irregular. The serpentine lies near on the E. side of Silver Creek, which appears to have cut along or near the contact of the two formations. The ruins of an old retort and furnace may still be seen near the mines.

PRODUCTION OF QUICKSILVER AT NEW ALMADEN, CALIFORNIA, FOR FORTY-ONE YEARS AND SEVEN MONTHS, FROM JULY, 1850, TO APRIL 30, 1894.

Date.	Class and Quantity of Ore.			Total Pounds.	Flasks from Furnaces	Flasks from Washing	Flasks—Total	Average Amount per Month—Flasks	Percentage Yield of Quicksilver	Number of Months.
	Grueso—Pounds.	Granza—Pounds.	Tierras—Pounds.							
July, 1850, to June, 1851				4,970,717	23,875		23,875	1,989½	36.74	12
July, 1851, to June, 1852				4,643,290	19,921		19,921	1,660	32.82	12
July, 1852, to June, 1853				4,839,520	18,035		18,035	1,503	28.50	12
July, 1853, to June, 1854				7,448,000	26,325		26,325	2,193¾	27.03	12
July, 1854, to June, 1855				9,109,300	31,860		31,860	2,655	26.75	12
July, 1855, to June, 1856				10,355,200	28,083		28,083	2,340¼	20.74	12
July, 1856, to June, 1857				10,299,900	26,002		26,002	2,167	19.31	12
July, 1857, to June, 1858				10,997,170	29,347		29,347	2,445½	20.41	12
July, 1858, to Oct., 1858				3,873,085	10,588		10,588	2,647	20.91	4
Nov., 1858, to Jan., 1861	Closed by injunction.									
Feb., 1861, to Jan., 1862				13,323,200	32,402	2,363	34,765	2,897	19.96	12
Feb., 1862, to Jan., 1863				15,281,400	39,262	1,129	40,391	3,366	20.22	12
Feb., 1863, to Aug., 1863				7,172,660	17,316	2,248	19,564	2,795	20.86	7
Sept., 1863, to Oct., 1863				2,346,000	4,820	700	5,520	2,760	18.00	2
Nov., 1863, to Dec., 1863	54,800	1,586,500	718,000	2,359,300	4,040	407	4,447	2,223½	18.65	2
Jan., 1864, to Dec., 1864	1,259,400	18,730,300	3,287,900	23,277,600	42,176	313	42,489	3,540¾	13.96	12
Jan., 1865, to Dec., 1865	2,288,900	25,749,000	3,910,500	31,948,400	47,078	116	47,194	3,933	11.30	12
Jan., 1866, to Dec., 1866	1,506,000	19,939,100	5,440,200	26,885,300	34,726	424	35,150	2,929	10.00	12
Jan., 1867, to Dec., 1867	731,500	15,689,288	9,603,145	26,023,933	23,990	471	24,461	2,038½	7.19	12
Jan., 1868, to Dec., 1868	2,274,208	14,566,600	12,564,722	29,405,530	25,577	51	25,628	2,135⅔	6.66	12
Jan., 1869, to Dec., 1869	150,000	11,942,175	13,366,000	25,458,175	16,898		16,898	1,408	5.07	12
Jan., 1870, to Dec., 1870	80,000	12,531,900	8,535,800	21,097,700	14,423		14,423	1,202	5.23	12
Jan., 1871, to Dec., 1871		13,661,700	8,373,000	22,034,700	18,563	5	18,568	1,547⅓	6.44	12
Jan., 1872, to Dec., 1872	142,000	12,777,000	8,497,600	21,416,600	18,391	183	18,574	1,548	6.63	12
Jan., 1873, to Dec., 1873		8,492,375	8,838,000	17,330,375	11,042		11,042	920	4.87	12
Jan., 1874, to Dec., 1874		11,294,000	12,160,000	23,454,000	8,867	217	9,084	757	2.96	12
Jan., 1875, to Dec., 1875		12,236,000	18,870,200	31,106,200	13,541	107	13,648	1,137⅓	3.35	12
Jan., 1876, to Dec., 1876		14,784,550	18,532,400	33,316,950	20,549		20,549	1,712¼	4.71	12
Jan., 1877, to Dec., 1877		13,987,700	23,243,600	37,231,300	23,996		23,996	1,999¾	4.93	12
Jan., 1878, to Dec., 1878		14,612,154	22,330,071	36,942,225	15,852		15,852	1,321	3.26	12

of the company, as shown by the records, is 265,938 ft., or $50\frac{86}{100}$ miles, at a cost of $2,262,011 42. This does not include the excavations made in extracting ore during the period named, nor any expense for the same, while for the ground opened up during the previous period (1850 to 1864) 15 more miles of drifting and sinking can be added.

The reduction works consist of eight furnaces, and include the most improved methods for working quicksilver ores, and may be considered as the most complete and perfect in every respect in the world.

ROBERT R. BULMORE.

NEW ALMADEN, CALIFORNIA, September 1, 1894.

New Almaden.—This large property has produced since 1850, during a period of 41 years and 7 months, 929,147 flasks of quicksilver, of 76½ lbs. each. The Enriqueta, also owned by the same company, produced 10,571 flasks additional. A tabulated statement of production of this famous mine has been prepared by Robert R. Bulmore, general agent of the company, covering this period, together with a short description of the mine and works, which is included in these notes. (See pp. 368, 369.)

During the past year a new shoot of ore was discovered in workings near the Santa Maria shaft, sunk for prospecting purposes only. This shoot has been followed downward and southward 200 ft. or more, and has been found to grow larger and richer as depth is attained. At this writing (March, 1894) the bottom of the stope is 20 to 30 ft. wide, 25 ft. high, and 50 ft. long. The mineral is making back into the foot-wall, and the prospect is bright for developing a large and valuable body of ore. Some of the richest ore ever obtained in the mine has recently been taken from this stope and from a point near the center of the shoot. The richest ore has usually been found heretofore on or near the hanging-wall. A brecciated condition of the rock, in which cinnabar occurs abundantly, is an interesting feature of the deposit. On the 600 ft. level one of the folds which have constituted a prominent feature of the New Almaden Mines occurs. A drift is being run from the Harry shaft, on the 700 ft. level, to cut under this fold, to determine whether or not this shoot is going down. It has been stated that the occurrence of native quicksilver in these mines was looked upon as an indication of near approach to the bottom of the shoot. Particular investigation on this important matter resulted in establishing the fact that native metal occurs on the lower sides of shoots, and is not an indication of the proximity of the end of the shoot. In the shoot of ore recently discovered, for some distance the lower edge was found to be rich in native mercury. Beyond this occurrence, and 60 ft. lower, the large chamber above referred to has been opened and is producing ore as rich as has ever been taken from the mine, while no native metal is found in this portion of the deposit that may be discovered with the unaided eye. The furnaces are nearly all in operation; 170 men are employed and 25 more by contract; of these 75 are working in the mines. See our VIIIth, Xth, and XIth Reports, pp. 541, 604, 394. New Almaden Quicksilver Mining Company, owners.

Wright Ranch.—Two miles S. of the New Almaden Mines, cinnabar occurs in sandstone on a tributary of Los Alamitos Creek. There are several cuts and short drifts, now caved and inaccessible. The rich ore, of which there was considerable, was packed out on animals and sent to furnaces. This work was done about thirteen years ago, and accurate information is not obtainable. The workings indicate that the cinnabar was found across a width of about 40 ft. It may be considered an encouraging prospect. On this ranch are several places where the surface is deeply stained with iron oxides, but no prospecting has ever been done.

SISKIYOU COUNTY.

Siskiyou Quicksilver Company's Mines.—They are situated near the headwaters of the West Fork of Beaver Creek, 15 miles W. of Cole's Station, on the C. & O. R. R. The developments consist of several hundred feet of tunneling and other workings. The reduction plant consists of

a 10-ton furnace. Siskiyou Quicksilver Mining Company, of San Francisco, owners; Jas. McCauley, of Oak Bar, agent.

SONOMA COUNTY.

Black Bear Consolidated Mine.—It is on Pine Flat, 2 miles from the Geysers, and comprises five claims on the quicksilver belt coursing W. from Mount St. Helena; between sandstone and serpentine.

Cinnabar King Mine.—This is in the "Pine Flat" country, a few miles from the Geysers and 22 miles N.W. from Calistoga. Six men are driving a deep tunnel to cut the ore body below the old works. The ore body is on the same mineral belt as the Ida Clayton and Yellow Jacket mines. See our XIth Report, p. 461. White Bros., of Healdsburg, owners.

Commonwealth Consolidated Mine.—It is 2 miles from the Geysers, and comprises three claims on a belt coursing W. from Lake County, showing a width from 20 to 80 ft., with a sandstone hanging-wall and a serpentine foot-wall. The ores are cinnabar and metacinnabarite, carrying on the pay shoot from 3 to 4 per cent of metal; the length of the pay shoot was 150 ft., with a width of 100 ft. The "alta" is found next to the hanging-wall. Developments on the mine reached a depth of 425 ft. through tunnels, and shafts below the tunnel level. There are two Knox & Osborne coarse-ore furnaces.

Geyser I and II Mine.—They are near the Black Bear Consolidated, and comprise two claims, on which only assessment work is done.

Great Eastern Mine.—See our VIIIth Report, p. 633. It is 4 miles N. of Guerneville. The Mount Jackson Mine, adjoining, has been consolidated with it. Since last reported the workings have been carried on in the upper part of the summit of the mountain in the Jackson Mine, which is the north extension. The best ore shoot is apparently near the dividing line of the two. The work is carried on through the Great Eastern shaft, extending into the Jackson ground to a depth of 220 ft. At the 140 ft. level of the Great Eastern shaft a drift 400 ft. long was driven to the ore body in the Jackson. The stopes, 40 to 50 ft. long, were worked 10 to 12 ft. wide, requiring only stull timbers. A tunnel 1,700 ft. in length, driven into the Jackson, cut the ground 150 ft. below the bottom of the shaft. The mine has been allowed to fill with water to the 150 ft. level, where it discharges through the Great Eastern tunnel, 1,000 ft. long. A compressor with two Burleigh drills is used. Last year's output was 1,400 flasks; the output at present is reported to be 120 flasks per month from one fine-ore and one coarse-ore furnace, with a capacity of 18 and 12 tons of ore, respectively, consuming 2½ cords of wood per day, costing $2 25 per cord. The company own timber land, from which the redwood timbers cost, laid down, 5 cents per running foot. A. Abbey, of San Francisco, Superintendent.

Hecla Quicksilver Mine.—This is in Pine Flat, and comprises one claim on the same ore belt. Only assessment work is done.

TRINITY COUNTY.

Altoona Mine.—It is in T. 38 N., R. 6 W., 22 miles N.E. from Trinity Center, on the headwaters of East Fork of Trinity River, and comprises 3,000 by 600 ft. The ore belt, 500 ft. wide, runs E. of S., dipping W.;

the quicksilver-bearing rock is about 12 ft. wide, having serpentine on one wall and a small belt of porphyry in immediate contact on both sides of the ore matrix. Near the surface the ore is said to carry from 3 to 4 per cent of quicksilver. The developments comprise a main tunnel 1,100 ft. long, passing through the ore body and beyond into strata of cinnabar ore on the west side; this tunnel will cut the double-compartment shaft, which is now under way, at 135 ft. depth; in future the mine will be worked through this shaft to secure dumping-ground. On account of the large drainage area, considerable water will have to be handled, for which purpose two Cornish pumps, a jackhead and a drawing pump, also a 4 in. Douglas force-pump and a No. 8 Knowles, will be put in. These and the hoist will be run by two 60 horse-power engines, while for the use of the fan and crusher a 12 horse-power auxiliary engine will be erected. Grading for a 40-ton "hard" ore furnace is being pushed ahead. Six miles of ditch conveys 80 in. of water to the mine. A sawmill is within 4 miles of the mine; timber for the present supply is at hand. Lagging costs 5 cents apiece; timbers 7 cents per ft.; freight is $1 30 per hundred pounds from Redding. Wages are $3 for miners and $2 50 for laborers; $6 a week for board; 60 men are employed. See our Xth Report, p. 716. Altoona Quicksilver Mining Company, owners; I. F. Cox, of Trinity Center, Superintendent.

Integral Mine.—It is 22 miles N.E. from Trinity Center, and embraces over thirty patented claims, besides timber lands, all lying between the East Fork of the North Fork of Trinity River and Crow Creek. The company employ 40 men. The ore body lies west of the Altoona, between serpentine and lime, the ore being in connection with spar and chalcedony, about 100 ft. wide. The developments comprise a shaft 230 ft. sunk on the ore body, and about 1,500 ft. of drifts running N. and S.; also a tunnel tapping the shaft at 120 ft. in depth, cross-cutting the limestone. The plant comprises a 30 horse-power hoisting engine, and a steam sawmill run by a 40 horse-power engine; also a soft ore furnace with a capacity of 20 tons per day, with 16 condensers—fourteen brick and two wooden ones. Water is obtained from Upper Crow Creek; 4 cords of wood are consumed per day; freight from Redding is $1 35 per hundred pounds by pack-train. Forty men are employed. Integral Mining Company, owners; W. J. Simpson, of Integral, Superintendent.

SILVER.

California has never been noted as a silver-producing State as compared with other precious-metal mining regions, yet there was a production of silver from sixteen counties last year aggregating $537,157. Of this amount, however, $447,020 came from the mines of Calico, San Bernardino County, which were enabled to continue working, notwithstanding the very low price of silver. Nearly all the remainder of the total was obtained in association with the gold in the ores from the gold mines. At one time—in 1884—the State produced $3,000,000 in silver for the year, but there has been a gradual falling off. The amount produced in 1893, however, showed a decided increase over that in the previous year.

ALPINE COUNTY.

Polaris Group of Mines.—There are included in this group six claims, namely: *Polaris, North Colorado, North Tarsus, Climax, Polaris Cross Claim*, and *Colorado Cross Claim*. The mines are situated in the Monitor and Mogul districts, north of the town of Monitor. They include the ground lying between the Stella and Colorado No. 2. They are developed by 1,000 ft. of tunnels and shafts. The vein on which most work has been done runs N. and S., and is small, but very rich in silver. The ore contains galena, zinc-blende, iron pyrites, and a rich silver-bearing mineral, probably stromeyerite. Cyrus Coleman, of Markleeville, owner.

INYO COUNTY.

Anaconda and Grand View Mines.—They are at Panamint. The Anaconda has a vein 12 ft. wide, on which a tunnel has been run a distance of 250 ft. The vein lies in limestone and carries argentiferous copper. Death Valley Mining Company, of Riverside, owners; R. Decker, of Panamint, Superintendent.

Consolidated Mine.—It lies 9 miles N. of Wild Rose Springs, in the Panamint range. The vein of white quartz is 2½ ft. thick, and carries a free-milling silver ore, which is shipped. It is developed by drifts and open cuts. The altitude is a little over 6,000 ft. Chas. Anthony, of Darwin, owner.

Emigrant Mine.—It is situated 12 miles N. of Wild Rose Springs. The ore occurs in bunches and irregular vein-form in a brecciated limestone, and is decomposed and much of it free milling. It is opened by a tunnel 100 ft. long.

Gold Hill Mines.—They are situated 15 miles S.E. of Panamint, on the eastern slope of the Panamint range. The veins lie in limestone, and have a N.W. and S.E. direction. The ore is galena and lead carbonate, carrying silver and gold. The silver is generally in excess of the gold in value. Death Valley Mining Company, of Riverside, owners.

North Star and Belvedere Mines.—They are situated 9 miles N. of Wild Rose Springs, in the Panamint range. The ore from these two mines is quite similar, consisting of copper and stromeyerite in a quartz gangue. They are opened by tunnels. Charles Anthony, of Darwin, owner.

Oroville Mine.—It is half a mile S.E. of Panamint. On this property there are four well-defined quartz veins, carrying a low-grade ore similar to the others in this district. Developments consist of one 40 ft. shaft and 400 ft. of tunnels. The veins run a little E. of N. and W. of S., and stand very steep. — Chickering, of Panamint, owner.

Pine Mountain Mines.—They are on Pine Mountain, on the eastern slope of the White Mountain range. But little work has been done for some time. The deposits are developed chiefly by tunnels. A 5-stamp mill and two Frue concentrators have been placed on the property. P. W. Forbes, of Big Pine, President.

Robert E. Lee Mine.—It is 7 miles E. of Wild Rose Springs, on the eastern slope of the Panamint range. The ore is gray copper, carrying silver. The vein has a width of 2 ft., and can be traced the whole length of the claim. Hunagan & Rose, of Darwin, owners.

Silver Queen Mine.—It lies 14 miles N. of Wild Rose Springs, on the Death Valley slope of the Panamint range. The elevation is about 3,000 ft. The deposit, a quartz ledge carrying the silver-bearing metals. stromeyerite and tetrahedrite, extends N. and S., between limestone and slate. The body of ore exposed on the surface is large, but apparently lies quite flat. It is opened by an incline 110 ft. deep and by a tunnel. The ore is sorted and shipped. The developments do not show the real position of the ore body. Charles Anthony, of Darwin, owner.

Surprise Mining and Milling Company.—This company holds in the vicinity of the town of Panamint a number of patented claims, namely: *Hemlock, Wyoming, Ida, Hudson River, Alabama, Eureka, Independence, Little Chief, Marvel, Comstock, Stewart's Wonder,* and *Challenge.* The veins, lying north of the cañon in which the town is located, have a general E. and W. trend; those on the south are more irregular in direction. They are all either in limestone or at its contact with mica schist. Most of the work has been done on the steep mountain slope. 300 to 600 ft. above the town. The deepest workings are on the Hemlock, where a shaft is said to have been put down 500 ft. The veins at Panamint are well-defined quartz ledges, generally dipping at a high angle. The earliest work was done here in 1873–74–75, when a mill was erected, which was burned after having run for some time. A 10-stamp mill is on the property at present, together with a roasting furnace. The ores are not high-grade, and though far from being worked out, cannot be made profitable with the present price of silver. It is rare that any galena is found here. The ore consists of gray copper, horn-silver, and stromeyerite. P. A. Graff, 212 Tenth Avenue, New York, owner.

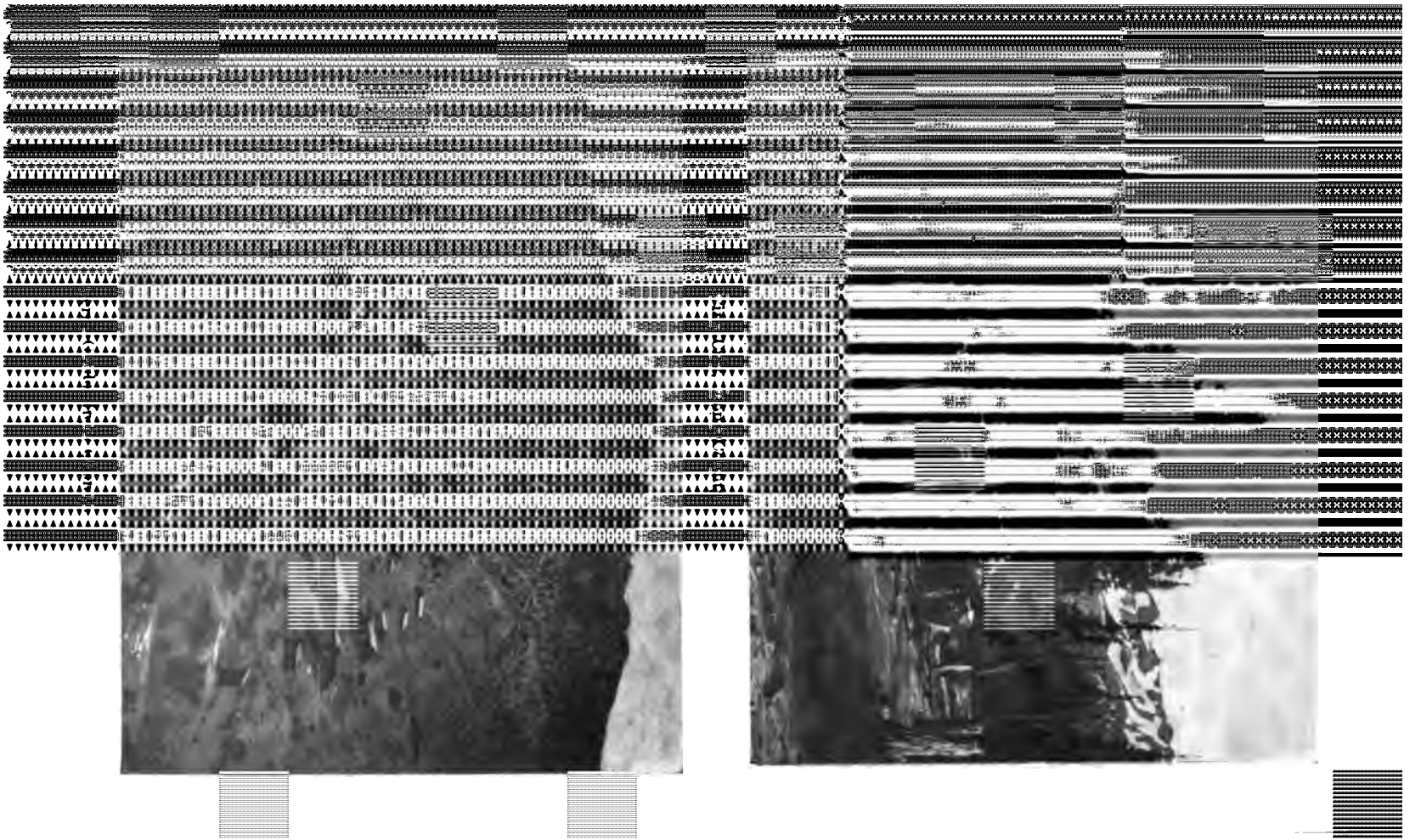
Sweitzer Mine.—It is on the eastern slope of the Inyo range, between Keynote and McAvoy cañons. It lies at an altitude of 7,000 ft. The vein is small but very rich, and is inclosed in granite. It runs N.E. and S.W., and stands nearly vertical. It is developed by a tunnel 130 ft. long and by surface work. The ore is shipped without any sorting. There is a little galena, but the richest ore is stromeyerite—a sulphide of silver and copper. James Starborough, of Lone Pine, owner.

Virgin Mine.—It is 3 miles N. of Wild Rose Springs, in the Panamint range, and is developed by a 40 ft. winze and numerous drifts. The gangue is a quartzose mica schist carrying tetrahedrite and antimonial ores, is inclosed in limestone, and is 40 ft. thick where the principal work has been done. The deposit can be traced for 1,000 ft. in a S.E. direction from the main workings. Chas. Anthony, of Darwin, owner.

Wild Rose District.—There are at least fifty other locations in this district besides those mentioned, but being idle their names and that of their owners could not be ascertained. Water is abundant at Wild Rose Springs, while 5 miles higher up on the range plenty of wood is to be found. This whole portion of the Panamint range is more or less mineralized, as shown by the numerous quartz veins and reddened outcrops. The strata are very greatly crushed and broken.

MONO COUNTY.

Barasca Mine.—This mine is situated on Blind Spring Hill, 3 miles E. of Benton. Since our last report it has been developed by 560 ft. of tunnel, and a considerable amount of stoping has been done. The



tunnel has been run 150 ft. below the old one, and the ledge found to preserve the same position which it had above. As far as developed, the ore shoot has been exposed for 40 ft. with an average thickness of 1 ft. On the dip of the ledge the tunnel has tapped it 335 ft. below the old tunnel. See our VIIIth Report, pp. 379–381. John F. Millner, of Benton, owner.

California and North Comstock Consolidated.—This property, consisting of several claims, is situated near the head of Ferris Cañon, almost on the summit of the Sweetwater range. Here occurs a large vein carrying silver and some gold. Little more than assessment work has been done on the property. A description of these mines, as well as the others in the Patterson District, was given in our VIIIth Report, pp. 357–362. A. Solderling, of Bodie, agent.

Comanche and Jaqui Mines.—They are situated on Blind Spring Hill, 2½ miles E. of Benton. They were fully described in our VIIIth Report, p. 379. John F. Millner, of Benton, Superintendent.

Cornucopia Mine.—It is situated on the summit of Blind Spring Hill, 3 miles E. of Benton. Since our last report the following developments have been made: One branch of the tunnel has been run south on the vein 400 ft., and a shoot of ore opened for a distance of 120 ft. The ore body averages 6 to 8 in. in thickness. See our VIIIth Report, pp. 79–81. John F. Millner, of Benton, owner.

Great Sierra Consolidated Silver Company.—The property of this company is situated in the Tioga District, near the summit of the Sierra Nevada Mountains. Described in our VIIIth and Xth Reports, pp. 371 and 342. Great Sierra Consolidated Silver Company, 66 Broadway, New York, owners; W. P. Oukst, of Lundy, Superintendent.

Kentucky Group of Mines.—They lie at an elevation of nearly 10,000 ft., on the eastern slope of the Sweetwater range. The property consists of three patented claims located on a vein running N. and S. and dipping at an angle of 30° to 40° W. The inclosing rock is a compact breccia of, perhaps, volcanic origin. In years past a large amount of silver ore was taken from this mine, the work being carried to a depth of between 200 and 300 ft. At present a tunnel is being run to cut the vein 200 ft. deeper than the old workings. This tunnel has now reached a length of over 400 ft. See our VIIIth Report, p. 360. J. H. Sheehan, of Clinton, owner.

Lady Hayes Mine.—It is situated on the north slope of Mount Patterson, Sweetwater range. It is developed by three tunnels. See our VIIIth Report, p. 360. E. Folsom, of Pine Grove, Nevada, owner.

Little Emily Mine.—It is on Blind Spring Hill, 2 miles E. of Benton. The property consists of two claims, the *Eureka* and the *Laurel*. They were located in 1865, and have been worked continuously ever since. The vein is quite flat, and is known as a "blanket ledge." It has been opened from the mouth of the tunnel for a distance of over 1,000 ft., and from 400 to 600 ft. on each side of the tunnel. The ore is said to be high grade, and to vary in thickness from 1 to 2 ft. A small amount of galena is present and some gold in places. Little Emily Mining and Milling Company, of Chicago, Ill., owners; John A. Wilson, of Benton, Superintendent.

NAPA COUNTY.

Palisade (Grigsby) Mine.—See our VIIIth Report, p. 413. It is 2½ miles N. of Calistoga, and comprises four claims, with veins running N. and S. and one N.W., and dip about 75° W., in places changing to nearly vertical.

Silverado Mine.—See our Xth Report, p. 363. It is on the southeast side of Mount St. Helena, in Sec. 2, T. 9 N., R. 7 W., and comprises six claims and a mill site. The vein courses N.E. and S.W., with westerly dip. Developments have been made through three tunnels, cutting the vein about 350 ft. below the highest outcrop.

SAN BERNARDINO COUNTY.

Calico District.—The principal silver mining district of this county is now, and has been for many years, in the Calico range. The great depreciation in the market value of silver has had a most depressing effect on the district, but the greater part of the time the Silver King Company has kept its mines operating and the mill running night and day. The long-continued litigation between the Waterloo and the Silver King has at last terminated in a compromise, and it is understood a consolidation of interests, with W. S. Edwards, of the Silver King, as General Manager. The mines are to be reopened and the mills so long idle will again be started, and many additional men employed.

During the year ending July 1, 1894, the principal work done on the silver mines, aside from the operations of the Silver King Company, has been by chloriders, who lease certain parts of mines and have the ores crushed in custom mills. The consolidated companies now own nearly all the larger mines and are well equipped to work them, and notwithstanding the low price of silver are likely to make a large production during the years 1894–95. See our VIIIth, Xth, and XIth Reports, pp. 508, 530, and 338.

Black Metal Mine (Silver and Copper).—This is 50 miles S.E. of The Needles, and about 3 miles back from the Colorado River. It has long been famous owing to the high grade of ore produced. The mine has never been operated extensively, and of late years not at all. There are three well-defined veins on the property. The principal development consists of a 30 ft. shaft and an 80 ft. drift. All the rock contains chrysocolla, and in some of it horn-silver is plainly visible.

Imperial Lode.—This property is in the Lava Beds District, comprising a vein nearly 8,000 ft. in length. It is practically idle, nothing but assessment work being performed on any portion of it.

Ivanpah District.—It is almost abandoned. At one time a producer of silver ore of extreme richness, the mines are idle and the once prosperous town is deserted. See our Xth Report, p. 531.

New York District.—It is 10 miles S.W. of Vanderbilt; it is a silver camp and the mines are all closed down.

Providence Mountain District.—At one time a prominent silver-producing region, made famous by the rich ore bodies of the Bonanza King Mine, it has been practically abandoned for several years past. The discovery of gold veins in the vicinity may result in a revival of mining in the district, but at this time it is purely speculative. See our Xth Report, p. 532.

Silver Reef District.—It is 45 miles E. of Victor, where there are numerous claims which have not been worked at all since the depreciation in silver. Small amounts of high-grade chloride ore have been found in many places on the reef. It has been described at some length in our XIth Report, p. 365. In all probability this region will never become prominent until silver reaches a much higher figure in the market than at present.

SHASTA COUNTY.

Afterthought Mine.—This patented claim is on North Creek, at the old village of Furnaceville. The property is not being worked, on account of the difficulty in handling the base ore. The former extensive works are rotting down. The mine was worked through tunnels.

Bully Hill Mine.—This property, comprising three patented claims, is 3 miles N. from Copper City. The ore bodies range N.E. and S.W., and carry from 15 to 18 per cent of copper, besides silver up to 40 oz. and near the surface $2 per ton in gold.

Extra Mine.—This is one fourth of a mile from Copper City. The ore body follows a N.E. and S.W. course, with porphyritic walls.

Iron Mountain Mine.—It is 8 miles N.E. of Shasta, on Iron Mountain, and comprises 1 mile square of ground, including three claims. The course of the mineral body is N.E. and S.W., and it can be traced for over 2 miles. It is apparently the iron head or gossan caused by heavy mineral springs permeating the fissure and surrounding rocks. The mass has been cross-cut in places over 500 ft. without reaching its boundaries. As depth is reached, the ferruginous and cupriferous oxidized mass changes to massive sulphides, sometimes of a steely nature and hardness. Tunnels have been run in, on what is taken for one of the walls, a distance of 500 ft., and a series of parallel cross-cuts made every 50 ft.; some of these are several hundred feet in length, all within the ore belt. The works from the upper tunnel have been entirely honeycombed and the ore sent into the mill. Near the surface the ore carries iron, copper, silver, and gold, said to yield in the mill 40 oz. silver and $1 gold. As depth is attained the percentage of gold increases. The reduction works include a fine 20-stamp dry-crushing mill and Bruckner furnace, 12 amalgamating pans, and 6 settlers, with a capacity of 75 tons per day. Has lately changed owners.

Last Chance Mine.—It is on North Cow Creek, 9 miles S. from Round Mountain. The vein courses E. and W. and dips S., between porphyry and conglomerate walls; it is 4 in. to 4 ft. wide and carries copper and lead sulphides, said to assay several hundred dollars per ton in silver, and also $2 per ton in gold. A tunnel has been run on the vein 26 ft.

Northern Light Mine.—This claim, 1,500 by 600 ft., is 1½ miles from Copper City. The ore bodies have a N.E. and S.W. course and S.E. dip, in porphyritic country rock. No regular vein formation exists here. The minerals carried are copper, silver, and gold.

Recorder Mine.—This claim, 1,500 by 600 ft., is 3 miles N. from Copper City. It carries copper and silver, with a little gold, and is being prospected by the owner.

South Fork Mining and Milling Company's Mine.—It is 2 miles W. of Igo, and comprises eleven claims on several veins. The principal ones are the *Black Prince* and the *Black Diamond;* these course E. of N. and dip about 45° S.E. They are near the contact between the slate and

granite, with a width of over 37½ ft. A number of shafts have been sunk and drifted from; at present they are full of water. The highly sulphuretted ore, when sorted, is said to yield 350 oz. of silver and $10 in gold per ton. Owned in Chicago; S. W. Robinson, of Igo, agent.

Winthrop Mine.—This claim is half a mile north from Copper City. The ore bodies range N.E. and S.W., between slate and porphyry. The mine is not being worked, on account of difficulty in treating the heavily sulphuretted ores, which carry iron, copper, antimony, silver, and gold.

STRUCTURAL MATERIALS.

In structural materials, mined or quarried, California is gradually advancing. For many years little or no use was made of our natural resources in this respect, but since the era of modern buildings and improved streets and roads, the demand has encouraged owners of deposits to develop them and market the products. Naturally those having the best facilities for transportation are the first to be opened; but there are many undeveloped properties, from which an increased supply can be obtained at any time demand and prices warrant.

Portland cement has been manufactured both at Santa Cruz, Santa Cruz County, and Benicia, Solano County; but this is not now being done at either place. Some, however, is being made in Riverside County. Large quantities of cement are imported here, but so cheaply as to prevent the development of local deposits.

California clays are utilized for the manufacture of pottery, terra cotta, sewer-pipe, fire-brick, architectural work, tiles, and building-brick. These industries give employment to large numbers of men, and the annual value of the products is increasing. In numerous places throughout the State large bodies of clays and kaolins of superior quality are known to exist, awaiting the demands of commerce for their development. They are mainly found along points on the granite ranges and at points where the former drainage basin gathered the fine slickens brought from the upper ranges.

In the census year the statistics showed that California stood No. 3 among the States of the Union in the use of granite. The value of the granite produced by the quarries of California in that year—1890—was upwards of a million dollars. Last year, owing to the business depression, there was a lessened demand, and consequently a smaller production. The granite is mainly used for building and curbing purposes. That from a new quarry in San Diego County is being used on the jetty at the entrance of San Diego harbor.

Numerous quarries of rock used for macadam on roads and streets are worked in the vicinity of all centers of population where there is a demand for the material.

Many varieties of marble are found in the State, and several quarries are now being operated. The stone is now more largely used than formerly for building and cemetery purposes.

As to lime, there are kilns to be found in many counties of the State, and the total output is very large. The value of the limestone product of the State exceeds half a million dollars per annum.

The manufacture of paving blocks from "basalt" and other rocks is not so important an industry as it was before the introduction of the bituminous rock for pavements, yet there are a number of quarries still being actively operated.

Sandstone quarries are worked in several counties, and the output of stone for building purposes is extensive. The industry connected with

this stone is now quite important, yet there are many known deposits not being worked.

The only slate quarries in the State now being worked are those in El Dorado County.

Steatite is only mined in a few places in California, and the total output is small.

Travertine and onyx are mined in a few places, some of the product being of very fine character.

Tufa is mined in several counties and used for building and ornamental purposes.

CEMENT.

CONTRA COSTA COUNTY.

In *Oil Cañon*, a mile from the village of Stewartsville, on the ranch of Col. Coats, of Brentwood, is a large ledge of impure limestone, which is at present undeveloped but appears to be 6 ft. in width. It strikes N. and W. and dips 30° S.W. Several tons of this rock have been shipped to Antioch, where a small experimental plant has been erected, with the purpose of making "Portland" cement of this rock.

RIVERSIDE COUNTY.

At Colton, the California Cement Company, of Los Angeles, has been perfecting arrangements during the past two years for the manufacture, by an improved process, of Portland cement, and are now producing 50 bbls. of fine hydraulic cement daily, employing 25 men. The material from which the cement is made is not a natural hydraulic limestone, but an admixture of lime, clay, and silica, after a theoretical formula—one which produces the best possible results. The quarries are at Colton, where large amounts of pure carbonate of lime are obtainable. This is ground and mixed with clay from the same locality.

SANTA CRUZ COUNTY.

Wagner's Park.—Several years ago a Santa Cruz company was organized to manufacture Portland cement from material obtained in a little gulch at a place known as Wagner's Park, 1 mile N. of Santa Cruz. A reverberatory furnace, a kiln, and the necessary grinding machinery were erected, and some cement produced which, reports say, was good, but the price of the imported cement being cut to a figure below the cost of local production, put a stop to operations in that direction. The material used in the manufacture of this cement was taken from a bed of calcareous travertine, a deposit from springs. This was ground with some clayey material found in a neighboring bluff. Neither of these deposits contain hydraulic lime, but the mixture in proper proportions resulted in a merchantable cement.

SOLANO COUNTY.

On the hills lying back of the town of Benicia, and in fact within the limits of the town, are extensive deposits of rock, which, until four years ago, was used in making cement. The article was once in demand, and

pronounced equal to the best imported. It is stated that over 130,000 bbls. were used in the construction of the New City Hall, in San Francisco. The cause of the suspension of active operations was not learned. The rock is buff in color, aphanitic in texture, and of medium hardness.

Deming's Point.—On the Johnson ranch, 2 miles E. of Vallejo, is a large outcrop of rock suitable for making cement. It is understood that work is soon to begin on this deposit. J. G. Johnson, of Benicia, owner.

CLAY, BRICKS, POTTERY, ETC.

ALAMEDA COUNTY.

California Pottery Company.—Its works are in East Oakland. At this establishment 12 men are employed in the manufacture of terra cotta and earthenware. When in full blast about 40 men find employment. The clay used by this company is obtained from the Clark deposits, at Carbondale, Amador County.

N. Clark & Sons' Pottery Works.—This is the largest pottery in the county. The works are in the city of Alameda. They manufacture vitrified ironstone sewer pipe, water pipe, chimney pipe and tops, etc. The clay used in the manufacture of these articles is obtained from the extensive deposits at Carbondale, in Amador County. At the works 40 men find employment, and at the clay pits 5 to 10 men are employed.

A clay occurs at the Laundry Farm, near Fruitvale, which is being tested at the Clark pottery. The results of the experiments have not yet been made public.

Remillard Brick Company.—This company, whose extensive plants are found in several counties of this State, have two Hoffman kilns in Livermore Valley, 5 miles S.W. of Livermore and 1½ miles N.E. of Pleasanton. In 1893 this branch of their works produced 10,000,000 bricks, employing 110 men for six months of the year, and 4 to 10 the balance of the year. The capacity of the works is 2,500,000 bricks per month.

CONTRA COSTA COUNTY.

Half a mile below the town of Somersville, near the railroad tunnel, a stratum of indurated white clay crosses the cañon. The deposit is 15 ft. in thickness and quite free from iron. It has never been developed in the least.

Fine clay also occurs in considerable abundance near the cement rock in Oil Cañon, near Stewartsville, and in the vicinity of the coal mines.

LOS ANGELES COUNTY.

City Brick Company has a large yard on College Street, in Los Angeles, and employs 35 men. The bricks are all burned in outside kilns. The annual output is 5,000,000. The clay is obtained from banks in the yard.

Joyce Brick Company, in manufacturing plain bricks, use one continuous kiln, and employ 25 men. The yard is near Buena Vista Street, Los Angeles.

Los Angeles Pressed Brick and Terra Cotta Company has a large plant near College Street, in Los Angeles, where are manufactured plain, molded, and ornamental pressed brick, architectural terra cotta, etc., and an imitation of mottled marble. The establishment at present employs 25 men, and at times 50. Most of the clay is from Carbondale, Amador County.

MARIN COUNTY.

Fortin Brick Company.—It has a large yard at Point San Pedro, where, in 1893, were made 12,000,000 bricks, including common stock and pressed varieties. There were 140 men employed during the summer months. All the bricks are made in the ordinary outside kilns, nine in number.

Lagunitas Station.—Near here, on Spring Creek, and on the ranch of A. Mailliard, are extensive deposits of clay, one variety being adapted to brick-making and the other has been employed in making tiles. Neither deposit is being worked, though both are well located near the railroad.

Patent Brick Company.—Its plant is at Brick Yard, a station on the S. F. & N. P. R. R., 4 miles N.E. of San Rafael.

Remillard Brick Company.—Its large yard is at Green Brae, 2 miles from San Quentin Prison. This concern, in 1893, made 6,000,000 bricks in its Hoffman kiln, working three and one half months, during which time 95 men were employed. In April, 1894, only 7 men were at work. This is but one of the three large yards owned by the Remillard Company.

NAPA COUNTY.

Brick clays are found and dug near Napa City.

NEVADA COUNTY.

In Sec. 3, T. 12 N., R. 9 E., as also N.W. of Nevada City, near the banks of the river, deposits of kaolin of sufficient size and purity to be available in the manufacture of the finer qualities of china are known to exist, but have never been put to any commercial use. Samples from the latter place are said to have been highly spoken of in Europe, where they were tested by experts.

Nichols Mine.—In Sec. 3, T. 15 N., R. 9 E., is an abandoned mine at one time worked for gold. The one wall of the quartz vein is a very white kaolin, apparently at least 6 ft. in thickness, that follows the vein for a great distance.

PLACER COUNTY.

The clays of Placer County have become a source of large manufacturing interest, from the great adaptability of the raw material to manifold uses. The large clay beds have undoubtedly been formed from the erosions and washings of the granite rocks that flank the east side of the county. Near the town of Lincoln these beds are furnishing the raw material for a large pottery.

Gladding, McBean & Co.'s Potteries.—These works are situated on the edge of the town of Lincoln, and employ 150 men. The works comprise

5 acres of buildings and sheds on the north end of the town, and 20 acres of ground nearly a mile away on the main road. The clay banks that furnish the raw material have a volcanic capping about 10 ft. in thickness. The material is dug and shoveled into carts that haul it to the works. The several grades being heaped by themselves, are mixed and worked over according to the finished product to be furnished. The works produce fire-brick, terra cotta ware, architectural work, ironstone ware, vases, flower pots, acid receivers, sewer pipe, and tiles. In the works are 15 circular and 2 long furnaces, besides the necessary mixing, grinding, and pugging mills. From 10,000 to 20,000 cords of wood are consumed per year at a cost of $60,000, being delivered from the surrounding neighborhood. For special purposes a small amount of a particular grade of clay is imported. The motive power is a 150 horse-power steam engine supplied by a battery of four boilers, the waste steam being carried through pipes under the drying-room floors. The payroll per month averages from $6,000 to $12,000, the wages varying from $1 75 to $8 per day. Reference to this property and the composition of the clays may be found in our IXth and XIth Reports, pp. 297 and 321. Gladding, McBean & Co., of Lincoln P. O., owners.

SACRAMENTO COUNTY.

Capital Sewer Pipe Works.—They are located in the eastern part of Sacramento City. See our Xth Report, p. 509.

Sacramento City.—In the southern outskirts of this city are the yards of Fountain Bros. and of J. Ryan. See our Xth Report, p. 508.

Sacramento Transportation Company.—This company has two large yards, one at Riverside and one at Freeport, being on the Sacramento River 5 and 9 miles, respectively, below the city of Sacramento. See our Xth Report, p. 506.

SANTA CRUZ COUNTY.

The F. A. Hihn brick-yard, on San Lorenzo Creek, near Felton, in 1893 turned out 100,000 bricks, which were used by the manufacturers in their own work. This concern only burns brick as they are required in their business as contractors.

There are vast beds of indurated clay in this county, but none of it is being put to any use. That on the Hodge ranch, near *Glenwood*, has been pronounced good, and some experiments made with it resulted satisfactorily, but the deposit remains unworked. A blue clay, which burns white, has been found in the *Valley of the San Lorenzo*, on the Zyante tract, but it has never been developed, and its extent is unknown.

Santa Cruz.—The bluffs all about the city of Santa Cruz contain large amounts of clay in thick-bedded deposits, of which no use is being made at present. There is also some clay in deposits in the bluffs of some small gulches tributary to the San Lorenzo Valley, said to be suitable for making some of the common kinds of pottery.

All the bituminous deposits in this county, as far as observed, are overlaid by a stratum of hard clay, some of which breaks with a conchoidal fracture, and seems quite free from iron.

SONOMA COUNTY.

Good clay occurs at a score of places along Sonoma Creek, between Glen Ellen and Sonoma. Several years ago large kilns of brick were burned at Glen Ellen and near Madrona Station, which were used in the construction of the Home for Feeble-Minded Children at Glen Ellen. but no bricks are made there at present.

Bagley & Nagle Brick-Yard.—This is situated 1½ miles W. of the town of Santa Rosa. When operating, 6 to 8 men are employed. The output does not exceed 500,000 bricks per annum. The bricks are burned in the ordinary manner in outside kilns. This yard is operated entirely to supply the local demand.

STANISLAUS COUNTY.

The Oscar Reed Clay Bank.—A good quality of pottery clay has been discovered on the ranch of Oscar Reed, in Sec. 3, T. 3 S., R. 11 E., M. D. M.

YUBA COUNTY.

Dempsey's Ranch.—A deposit of a good quality of white clay, mixed somewhat with iron sulphides, has been found on John Dempsey's ranch. 3 miles S.E. from Smartsville, in Sec. 2, T. 16 N., R. 5 E. It has been proven to be 12 ft. wide and 1,500 ft. long. Nothing is being done with it. It is 18 miles from the railroad, and there is an abundance of water and pine and oak timber in the vicinity.

GRANITE.

Among the rock formations suitable for building purposes at present made use of in the State, the granites easily take the first rank, being found throughout the whole length of the State; but as the question of transportation figures largely in the use of such materials, only those localities have so far become prominent that have easy access to railroad or water communication with the principal cities of the State. Thus we find granite quarries along the railroads that flank and cross the western slope of the Sierra Nevada Mountain ranges, more especially in the counties of Sacramento, Placer, Nevada, Madera, etc.

CALAVERAS COUNTY.

Granite of fine texture and valuable as a building-stone is found in the West Point District, but is not quarried, except in limited amounts.

PLACER COUNTY.

Brady Quarry.—This is in Sec. 29, T. 11 N., in Rocklin District, near the C. P. R. R. It is a small property. — Brady, of Rocklin, owner.

Burns & Coffey Quarry.—This is situated in Lincoln, a railroad station between Sacramento and Marysville. The work of the quarry consists mainly in working up granite bowlders. The owners employ 4 men, 2 of whom are stonecutters. Two derricks are used. Burns & Coffey, of Lincoln, owners.

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GRANITE.

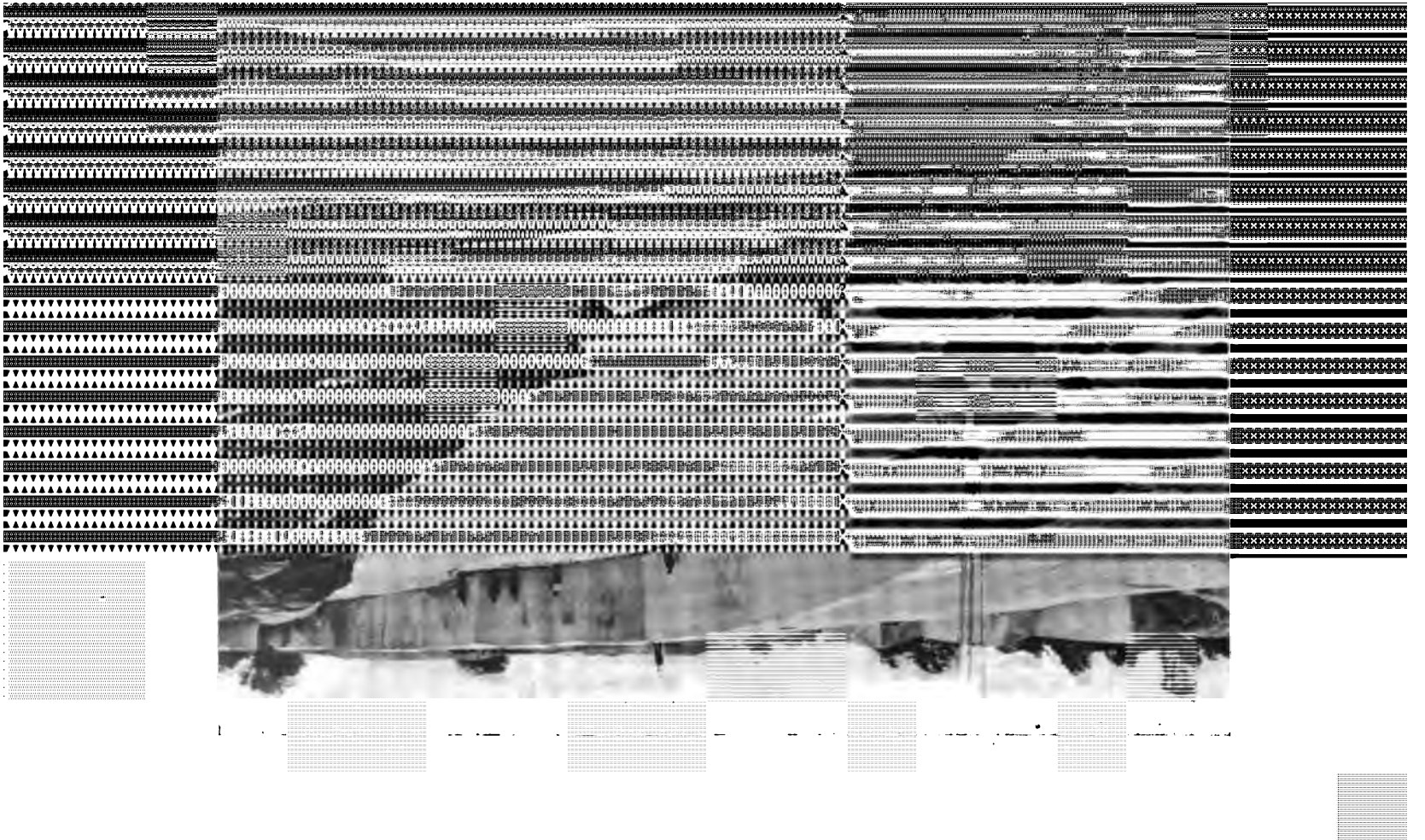
MADERA COUNTY.

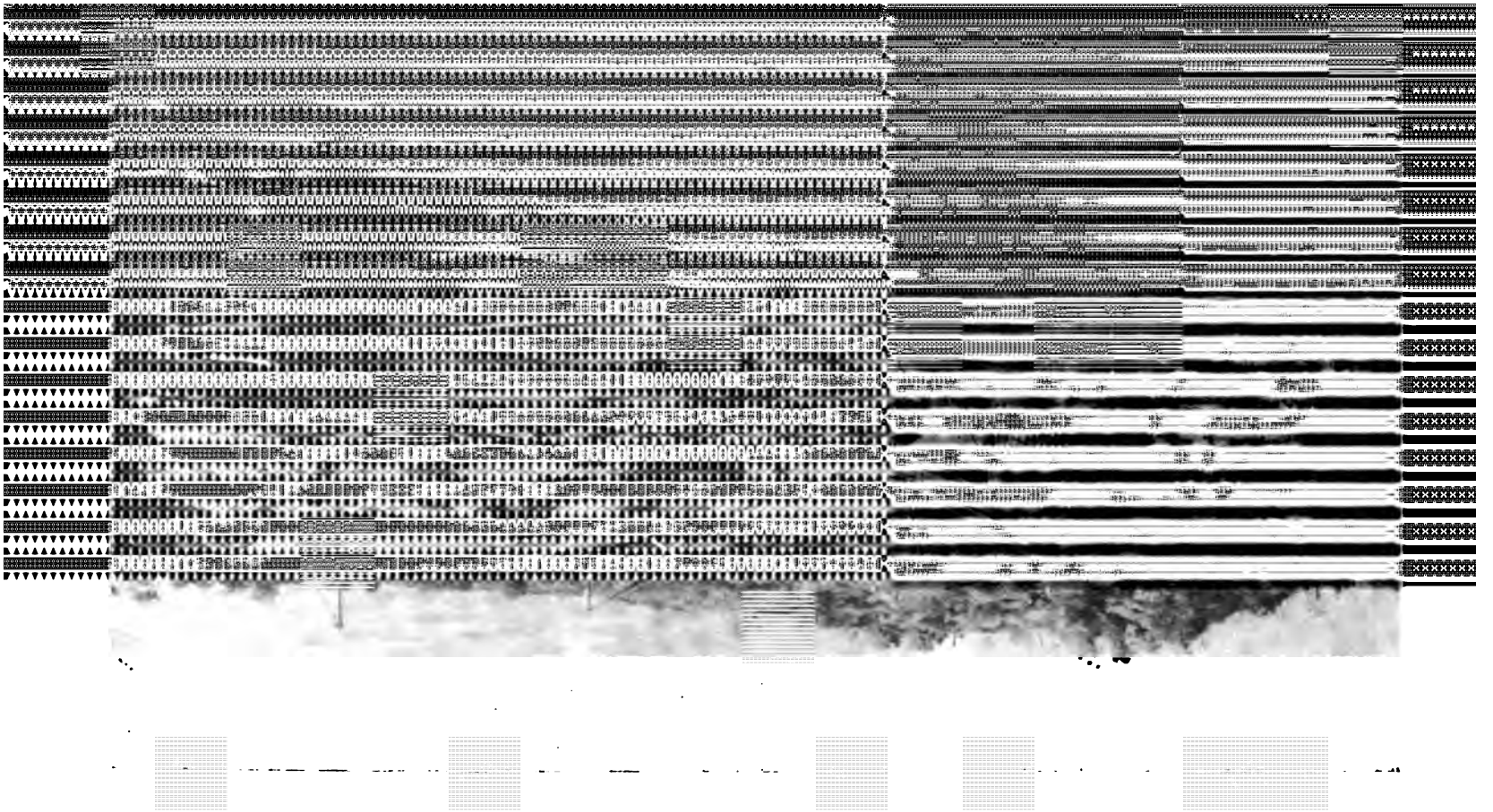
The general appearance of the country about the town of Raymond would scarcely suggest the existence of fine quarries of granite, as the hills are smooth and rolling and the surface rock usually much decomposed to a considerable depth. Here and there are found large masses of hard, firm rock, in some of which quarries have been opened.

The Day Quarries.—There are two quarries, one being 3 and the other 4 miles S. of Raymond. These quarries being both new gave employment to but 33 men. The granite in quarry No. 1 of the Day Company is similar to that of the Raymond and McLeanan companies, excepting that in some portions of the mass large crystals of hornblende half an inch or more in length have developed. The Day quarries each are in close proximity to the railroad.

McLeanan Quarry.—This is 3 miles S.E. of Raymond, on a spur of the railroad. This quarry employed 50 men in May, 1893. The quality and general appearance of this granite are similar to that of the Raymond Quarry.

Raymond Quarry.—This property is 3½ miles S.E. of the town of Raymond. It has a superior location on a large dome-shaped hill in which the granite occurs in concentric layers, conforming in a general way to the contour of the hill. The blocks of stone are of immense size. The one on which the work was being concentrated in the spring of 1893 was 325 ft. long, 5 to 15 ft. in thickness, and exposed for 50 ft. in width, without seam or flaw. The granite is fairly fine-grained, light gray in color, consisting of quartz, orthoclase felspar, some plagioclase biotite mica and hornblende. It has a remarkably even texture, free from those spots caused by the accumulation of the dark-colored minerals which are so objectionable in structural material. A spur from the railroad runs directly into the quarry; 70 men were employed in May, 1893.





Calderwood Quarry.—This is a small quarry in Lincoln. — Calderwood, of Lincoln, owner.

Copp & Waters Quarry.—This is in Sec. 29, T. 11 N., in Rocklin District. It is one of the larger quarries of the county, having a lease of 40 acres of ground and employing 25 men, of which number 16 are quarrymen and stonecutters. Two steam derricks are in use, run by a 25 horse-power horizontal engine. They work on an outcrop 25 ft. high. Copp & Waters, of Rocklin, owners.

Eureka Quarry.—The workings are on leased ground, and consist of a pit 200 ft. long by 75 ft. wide and 70 ft. deep. The equipment consists of a horizontal engine and two derricks. Nine men are employed—7 quarrymen at an average pay of $2 40 per day, and 2 stonecutters at $4 per day. The principal market for the granite is Sacramento, San Francisco, San José, and Stockton, and the cost in the rough f. o. b. is 85 cents per cubic foot. Eureka Quarry Company, owners; A. M. Grindell, of Rocklin, Secretary.

Gould & Towle Quarry.—This is situated 250 yds. from the main C. P. R. R. track, 4½ miles from Emigrant Gap Station, at Yuba Pass; a side track connects the quarry with the main line. The granite is hard, and of pretty good quality. The pit is small as yet, but well situated as regards dumping facilities, wood, water, and accessibility. It is supplied with a derrick and a small steam engine with upright boiler and 18 in. cylinder. Gould & Towle, of Dutch Flat, owners.

Griffith Quarries and Polishing Works.—These are half a mile E. of Penryn. Four men are employed at present, but when full-handed there are about 200 at work. The property lies in Sec. 35, T. 11 N., R. 7 E., comprises 300 acres, and produces two qualities of granite, white and black—it is said to be the only true black granite quarry in the State—and consists largely of bowlders. The price of the granite in the rough is, for small blocks, $1 per cubic foot; for pieces weighing from 10 to 20 tons, from $2 50 to $3 50 per cubic foot. The granite belt courses N.W., and has been sunk on in these works to a depth of 75 ft. It is claimed that the stone will not fade or change color. This quarry is supplied with polishing works, which cost $20,000, situated between Penryn and the quarry, adjacent to a railroad siding. They contain the requisite machinery to turn stone columns 30 ft. long; also for polishing curved surfaces, and blocks of stone 25 ft. long by 6 ft. wide. It takes seven days to polish such a block. D. Griffith, of Penryn, owner.

Grimes Quarry.—This is near Lincoln and employs 4 men—2 stonecutters and 2 quarrymen.

Jeter Quarry.—It is at Lincoln. There is a small pit 30 ft. deep, requiring two derricks and giving employment to 5 men—2 stonecutters and 3 quarrymen. Mrs. Keller, of Lincoln, owner.

Kent Quarry.—This is in Sec. 29, T. 11 N., in Rocklin District, on 10 acres of leased ground. When the property is being worked 5 stonecutters, 5 quarrymen, a teamster, and a blacksmith comprise the crew. Three small derricks are used, manipulated from a small upright engine. S. Kent, of Rocklin, owner.

Paran Quarry.—This is near Lincoln, and is worked with a force of 2 stonecutters and 2 quarrymen. Paran Bros., of Lincoln, owners.

Quinn Quarry.—This is in Sec. 29, T. 11 N., near Rocklin. The property contains 150 acres. The quarry is small, using two derricks

and employing 12 men; 3 of these are stonecutters. Mrs. Mary Quinn, of Rocklin, owner.

Robert Bros.' Quarry.—This is near Penryn; a small concern, employing 3 men, working on leased land. Robert Bros., of Penryn, lessees.

Rocklin Quarry.—This property of 80 acres is in Sec. 29, T. 11 N., near Rocklin. The main pit is 300 ft. long, 175 ft. wide, and from 100 to 125 ft. deep. It is supplied with four large derricks, capable of handling blocks weighing from 25 to 30 tons. They are now erecting a traveler, polisher, and steam dresser. An Ingersoll machine drill is used where practicable. This quarry has been worked from sixteen to eighteen years, and has a yearly output of 3,000 tons of finished material; 10,000 tons of rubble are disposed of for ballast, and 250 tons for street blocks. There are 20 quarrymen employed at $2 50 per day, and 32 stonecutters at $4, besides an engineer, teamster, 4 blacksmiths, and 2 tool-boys—60 men in all. Besides the local markets in this State, shipments are made to Oregon and Washington. The railroad freight charges from this point are, for rough ashler, $2 50 per ton; for finished work, $3 50. J. L. Delano, of Rocklin, President and owner.

Tamarack Quarry.—This is about 4 miles beyond the C. P. R. R. station at Cisco, in immediate proximity to and on the upper hillside of the track, permitting the blocks to be brought to the cars by gravity. A face of several hundred feet can be obtained over 100 ft. in height above the track level. The granite shows a granular crystalline texture. The planes of the formation are nearly vertical. C. P. R. R. Co., of San Francisco, owners.

SACRAMENTO COUNTY.

State Granite Quarry at Folsom.—Capt. Charles Aull, Warden of the Folsom Prison, states that during the four years ending June 30, 1894, more than 120,000 cu. yds. of granite were taken from the prison granite quarry. That of this amount about 110,000 cu. yds. were used in the dam, canal, and power-house constructed by the Folsom Water Power Company in conjunction with the State of California, and that about 3,000 cu. yds. of granite have been used in a new cell-building. In the latter building very massive masonry is employed. Thus, in the new dungeon there are blocks of stone 8x2x2 ft. In the roof of the ordinary cell some of the blocks of stone are 92x25x36 in. He also says that other buildings are in course of erection which will require about 3,000 cu. yds. of granite, a large portion of which is already quarried.

SAN BERNARDINO COUNTY.

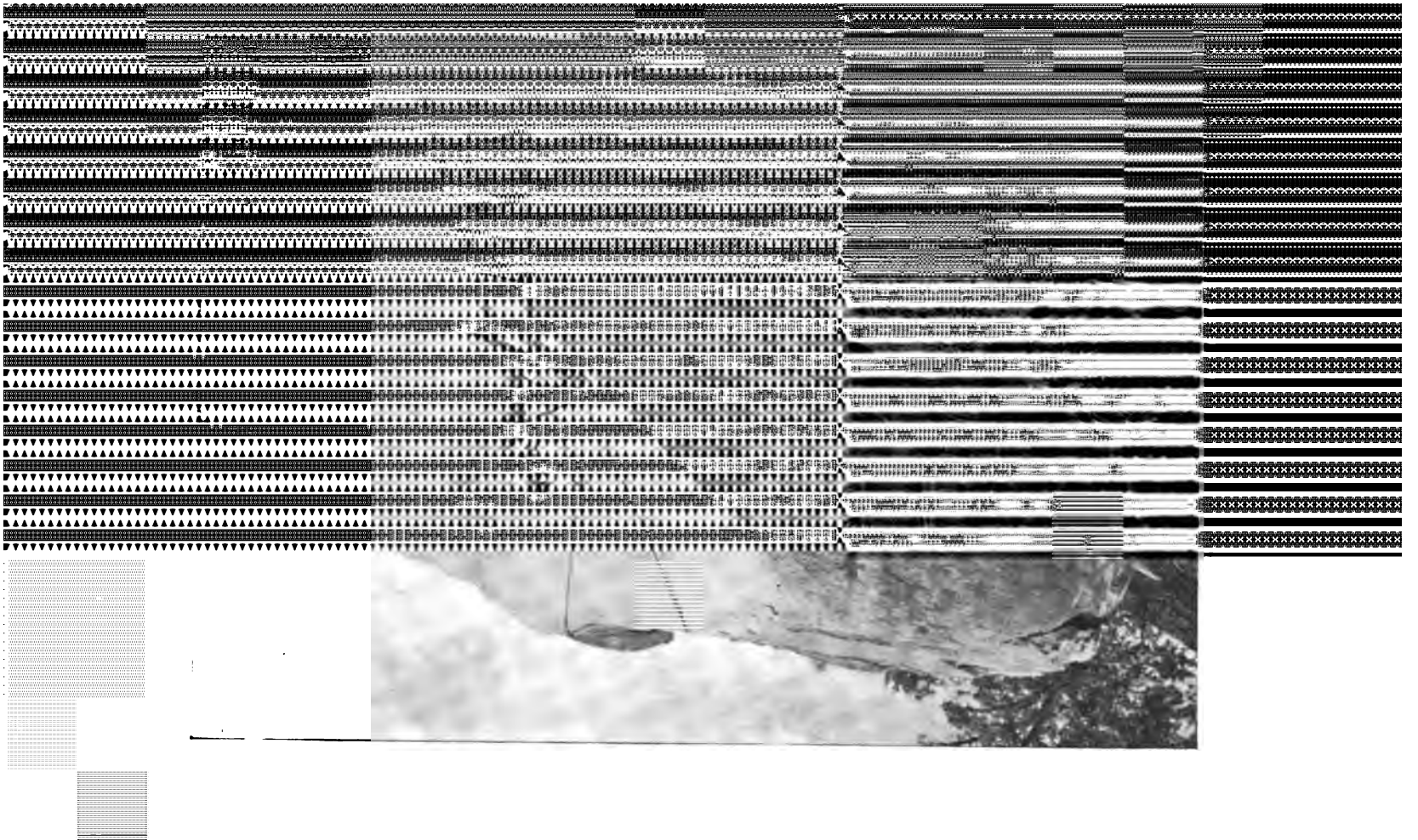
Turner & Leahy Quarry is being opened, 3½ miles N.E. of Victor Station. The granite is fine and even textured, and occurs in great massive blocks, which can be quarried in any size to suit requirements.

Clemens Quarry is on the Southern California Railroad, 3½ miles N. of Victor. Six men are working.

St. John Quarry, half a mile S. of Victor. Idle.

SAN DIEGO COUNTY.

The Waterman Quarry has been opened but a few months. It is situated on the Cuyamaca and Eastern Railroad, at Forster Station. Here 50 men are employed quarrying rock for the jetty being built at



the entrance of San Diego harbor. An average of 20 carloads of stone are shipped out daily. A spur of the railroad has been built into the quarry, and every facility provided for the economical and speedy handling of the large quantity of material being removed.

The Rockfellow & Clark Quarry is 2 miles above Forsters, in the same cañon. Only a small force is employed on contracts, and these do not find work constantly.

SANTA CRUZ COUNTY.

There is a poverty of good building-stone in this county. Several attempts have been made to open quarries, but none have developed good stone in sufficient quantity to make their quarrying profitable.

The trimmings of the court-house are from granite bowlders found on Blackman Gulch, a short distance E. of Santa Cruz, and is the best granite ever found in the county, though that is rather coarse-grained and dresses roughly.

Some granite of loose texture is taken by the railroad company at various points along the line, and the rock used for ballast, etc.

Delaney Quarry.—It is on Laguna Creek, 12 miles N.W. of Santa Cruz. The rock is too soft, and does not occur in masses large enough to make the stone merchantable.

Kerr Ranch Quarry.—This quarry, 2 miles E. of Santa Cruz, has been abandoned, owing to the poor quality of the stone, and all attempts to find more serviceable granite have been given up.

A dike of dark-colored, bluish rock (diorite) occurs in the granite at Agua Caliente, on the S. P. R. R., near Pajaro Station. The dike is 5 to 6 ft. in thickness and the rocks take a fine polish. The ledge is too small to make a quarry profitable, unless a very high price was obtained for the stone.

TRINITY COUNTY.

Rush Creek Quarry.—It is 6 miles E. of Weaverville, on Rush Creek. A 200 ft. face is being opened; the granite to be used principally for ornamental and monumental purposes.

TULARE COUNTY.

Griffith & Owens Quarry.—This quarry is at the eastern base of Rocky Hill, about 3½ miles E. of Exeter, on the S. P. R. R. The granite is gray syenitic rock, of very uniform texture and color, which splits readily in any direction and takes a fine polish. It occurs in large detached masses and flattened beds; the latter pitch a little E. of N. at an angle of about 30°. These beds vary from 3 to 25 ft. in thickness, and are so situated that a back of any required height may be obtained to the quarry. The "rift" appears to be E. and W. This stone has been used in San Francisco, Oakland, and other cities. In quarrying this rock two holes are drilled about 15 in. apart, and at such an angle that they intersect one another about 6 ft. below the surface. The holes are first charged with 6 in. of black powder and fired; they are then loaded with 8 in. of black powder and fired again; lastly they are charged with 12 in. of black powder and fired. By this means a block of granite 40x25x40 ft. is sometimes split through its greatest length. Ten men are employed in this quarry. Griffith & Owen, of Exeter, owners.

MACADAM.

ALAMEDA COUNTY.

The business of quarrying rock for macadam and concrete is quite an important industry of this county, no less than 250 men finding employment in the quarries and in work connected directly with the business, principally teaming, building concrete walls, and macadamizing streets. The busy time of the year is during the summer months. The winter force is not more than one third of that employed in summer.

The rock produced at the various quarries in this county, with the exception of that at Laundry Farm, is the altered greenish-gray sandstone common to the Coast Range. Only that at the Farwell Quarry is suitable for building-stone.

California Improvement Company's Quarry.—It is on the Laundry Farm, 1 mile N. of Mills College, and on the summit of a prominent ridge. The rock is anamesite, a variety of basalt of extremely fine texture. As far as opened, the quarry exposes no rock suitable for building-stone. A gravity tramway connects the quarry with the breaker works and bins, which are at the upper terminus of the California Railroad. In 1893 the monthly production was 5,000 cu. yds., and in 1894 to May 1st, 7,000 cu. yds. The output later in the season is expected to exceed this. In the busy season from 50 to 60 men are employed, and in the winter 25 to 30. Indirectly, on contracts, teaming, etc., 35 to 65 men are employed, according to the season.

Claremont Quarry and Paving Company.—Its quarry at Claremont is in the foothills between Oakland and Berkeley, near the head of Little Lake Chabot. There were 28 men employed last spring.

Farwell Quarry.—It is in Rocky Brook Cañon, a tributary of Niles Cañon. The quarries are on each side of the gorge in which they are situated, about 1½ miles from the railroad, and are in two groups, being situated on each side of an anticlinal fold. The rock is shattered and broken, and much waste results from quarrying. Its color is a dark bluish-gray; that of those portions near the surface is buff and light gray. The stone is very durable, and commands a good price in the cities of Oakland and San Francisco. In 1893 about 10,000 cu. ft. of rock were shipped. From 10 to 20 men are usually employed.

McAdams Quarry.—It is in Medos Cañon, back of Piedmont, and is a small quarry, producing sandstone for rubble and ashler. It is not worked regularly.

Oakland Paving Company's Quarry.—It is on McAdams Street, near Broadway, Oakland, and is a very large quarry, which has been operated for twenty years or more. This quarry has produced from January 1 to May 1, 1894, about 6,000 cu. yds. of rock for macadam and concrete. Steam power drills are used, and 50 men are employed.

Piedmont Paving Company's Quarry.—It is in the foothills back of Piedmont, about half a mile from the site of the old Piedmont Hotel. During the summer season of 1893, 20,000 cu. yds. of broken rock were produced, 35 to 40 men being employed.

Sheep Island Quarry.—It has not been operated since the breaker works were burned a year or two since, and as far as learned there is no prospect of an immediate resumption of operations.

LOS ANGELES COUNTY.

At *Acton*, on the line of the S. P. R. R., 55 miles N.E. of Los Angeles, occurs a dark-colored, half-glassy lava, suitable for rubble work, macadam, and perhaps also paving-blocks and building-stone. It is admirably situated for quarrying and loading on cars. The deposit is entirely undeveloped, except for a little taken for local use.

MARIN COUNTY.

Forbes Quarry.—This is on the hillside N. of San Rafael, and in 1893 produced 6,000 cu. yds. of flint rock, which was crushed and used for macadam on the streets of San Rafael, and in concrete work. There were 700 cu. yds. quarried in April, 1894. When in full operation, 30 quarrymen and teamsters are employed.

Hotaling Quarry.—This is situated in the southwestern suburbs of the city of San Rafael. In winter 3 men are employed, but in the summer season 8 to 10 men are kept busy. In 1893 this quarry produced 1,600 cu. ft. of rubble rock, and in 1894 to May 1st, 11,000 cu. ft. A rock-breaker is to be set up at this quarry to crush the waste for macadam and concrete work. This quarry has produced within the past year 10,000 ft. of gutter rock. The rock is the dark bluish-gray sandstone common to the Coast Range. A dike of light-colored, much decomposed rock 20 ft. in thickness is exposed in the quarry.

Mount Tamalpais Quarry.—It is worked occasionally by the Mount Tamalpais Cemetery Company to get rubble rock and macadam. The rock is a bluish-gray metamorphic sandstone. The quarry has never been extensively opened. The stone is hard and well suited to the purposes for which it is used.

Parrott Quarry.—It is in the west suburbs of San Rafael; has been idle for some time past.

SAN FRANCISCO COUNTY.

The only rock industry of San Francisco consists of the quarrying of the blue metamorphosed sandstone common to the Coast Range, and of the red jasper rock. These rocks are excavated from the quarries mostly in the southwest suburbs of the city. There is also one quarry on Telegraph Hill. The material is used in making the concrete foundations of buildings, cement sidewalks, and in some instances concrete walls for buildings, several of which have recently been constructed. The material also finds a limited use as macadam. A large quantity of the blue sandstone has been placed in that portion of the seawall at the new ferry slips foot of Market Street. This rock has not been in place a sufficient length of time to determine what action, if any, the salt water will have upon it.

Blue Rock Quarry.—It is at the corner of Douglas and Twenty-sixth Streets. The rock from this quarry is that placed in the seawall. It is also used to a limited extent for ashler. From 10 to 20 men are employed. The estimate of the production for the year 1893 by the owners is 27,000 cu. yds. Gray Bros., 310 Montgomery Street, San Francisco, owners.

Eureka Stone Quarry.—It is at the corner of Eighteenth Street and Corbett Road. The rock quarried here is iron-stained, and of the jasper variety. The rock-mass shows a decided tendency to break up in small angular fragments with nearly parallel sides. From 30 to 35 men find employment at this quarry. In 1893 it is estimated that 47,000 loads were marketed. Champion, Elder & Co., 302 Montgomery Street, San Francisco, owners.

Flint Tract Quarry.—It is on the opposite side of the hill from the Wegscheider Quarry, and is at the corner of Tilden and South Broderick Streets. Twenty men are employed. A new crusher and sizing plant is now being erected (March 1, 1894). Diggins Bros., 16 Post Street, San Francisco, owners.

Telegraph Hill Quarry.—It is on Telegraph Hill, near the corner of Sansome and Green Streets. The rock quarried here is sandstone similar to that at the Blue Rock Quarry. The owners state that during 1893, 30 to 40 men were employed, and the output is estimated at 35,000 cu. yds. Gray Bros., 316 Montgomery Street, San Francisco, owners.

The Warren Leases.—One is near the Flint tract quarries, another on Bernal Heights. Neither of them are working at present, and are seldom operated steadily. Chas. Warren, Ninth Street, near Howard, San Francisco, lessee.

Wegscheider Quarry.—It is situated in the Flint tract. The quarry employs 20 men, and in 1893 produced 15,000 cu. yds. of rock. Wegscheider & Co., 404 Seventeenth Street., San Francisco, owners.

There are in addition to the quarries mentioned several small ones, which are operated at intervals, the owners not making a steady business of it.

SOLANO COUNTY.

Benicia Rock Crushing Company's Quarry.—It is on the line of the S. P. R. R., half a mile N. of Goodyear Station. The rock is of volcanic origin, and is seemingly a portion of the flow which occurs at Cordelia and northward. It was used formerly for paving-blocks, but the uneven wear due to its varying hardness made it valueless for this purpose, and it is now broken for macadam and concrete. Twenty-five men are usually employed.

Thomason Quarries.—These are 1 mile E. of Cordelia, and produce principally paving-blocks; the refuse is run through rockbreakers and used for macadam. In busy times 60 to 70 men find employment, and in ordinary seasons (summer) at least 20 to 30.

SONOMA COUNTY.

On *Castle Hill*, in the city of Petaluma, is a large quarry, from which material is obtained for macadamizing the streets of the city and the county roads near the town. It is supplied with large bins and breakers. The quarry is managed by J. L. Hall.

MARBLE, LIMESTONE, AND LIME.

AMADOR COUNTY.

Carrara Marble Quarry.—This property is situated 6½ miles N.E. of Jackson, on Sutter Creek. The marble found in this quarry is fine-textured, quite white, but lightly banded or mottled with bluish streaks, veins, and clouds. The stone is shipped by road and rail to San Francisco, where it is sawed and dressed. There are a number of quarries on this belt, but the above-mentioned quarry is the only one of importance. It is worked intermittently as the demand requires.

Miscellaneous Quarries.—Marble occurs at numerous places in this county, but none of them are regularly worked.

Seven miles N.E. of Ione is a large reef of red crystalline limestone (marble), which is fully described in our VIth Report (Part I), p. 22. The quarries are idle.

Some quarries on the road between Plymouth and Oleta produce marble of good quality. These quarries are idle.

CALAVERAS COUNTY.

Marble is abundant, though not quarried regularly. Some very fine marble occurs at the mouth of Wade's Gulch, on Coyote Creek, 2 miles below Vallecito. Marble of good quality is found near the Stanislaus, opposite the Columbia quarries, in Tuolumne County. Large quarries have been opened near Valley Springs, which produce an excellent marble.

EL DORADO COUNTY.

Although there are several bodies of limestone and some good qualities of marble to be found in this county, the resources in this direction have not been very largely developed.

Bind & Co.'s Marble Quarry.—This is 5 miles S.E. of Placerville, and 4 miles from Diamond Springs, on Weber Creek. The property consists of 160 acres of ground, 1 mile long on the course of the belt, which is W. of N., by one fourth of a mile wide. The same belt can be seen on the American River, where it shows about 50 ft. wide; both N. and S. it appears to wedge out. There are three varieties of the marble: milky-white, brown and white mottled, and blue-gray. A face of 150 ft. in length can be made, and a track will be laid down-grade to the railroad at Diamond Springs. Water power may be obtained through the Crawford system of ditches, and the necessary saws and polishing tables have been ordered. Ed. Bind, of Placerville P. O., owner.

Cave Valley Lime Company.—The property of this company is situated on the stage road between the American River and Cool, a stage station 5 miles S.E. from Auburn. The works are only run during the summer months. The belt of blue limestone is about 1,000 ft. wide, and can be traced on a N.W. course over 4 miles. The two patent kilns are situated on the main road, while the quarry is opened on the upper side of the road on a level with the top of the furnaces. The kilns are 30 ft. high, 6 ft. across, with two fires, consuming 4 cords of wood per day. The kilns work continuously; a charge is drawn every four hours, producing from 150 to 160 tons per month. Wood is cut in the neighborhood and

costs $3 per cord. The lime is hauled to Auburn for $4 per ton, and is sold for $15 per ton at retail, or $10 per ton by the carload. When working, 8 men are employed, 3 of them in the quarry. W. Davis and Henry Cowell, of San Francisco, owners.

INYO COUNTY.

Inyo Marble Company.—The quarries of this company are situated at the base of the Inyo range, between Keeler and Lone Pine Station. Their claims are scattered along the base of the range for several miles, but the point at which most of the work has been done is about 5 miles N. of Keeler. The management of the quarries has recently changed, and several new and apparently excellent beds of marble have been discovered. One of the best of the new locations lies about 2 miles S. of the old works. Although not opened up at the time of the Bureau's examination, there is shown a large body of banded and variegated marble, free from cracks and flaws, so that large pieces can be obtained. This marble varies from nearly white to gray and black in bands, and often beautifully mottled and knotted. For the general purposes of a variegated marble it would seem that this would completely fulfill the requirements. A little south of the old quarries a bed of fancy variegated marble is being opened. It is mottled with white, yellow, gray, and black, and is penetrated by beautiful dendritic markings of manganese. The old quarries of white marble are to be abandoned, because of the broken condition of the rock, and a new one has been opened near by. The marble found in the latter gives promise of a more perfect white color, and of being obtained in larger blocks. Recently pieces of 15 to 18 tons weight have been obtained. A half mile north of the main works a new quarry of yellow marble is being opened. A deposit of black marble of good quality has also been found, and is employed chiefly for floor tile. Development work is being actively pushed, and it is expected from present indications that the demand will rapidly increase. These quarries were described in our Xth Report, p. 215. Inyo Marble Company, of San Francisco, owners; M. J. McDonald, Mills Building, President.

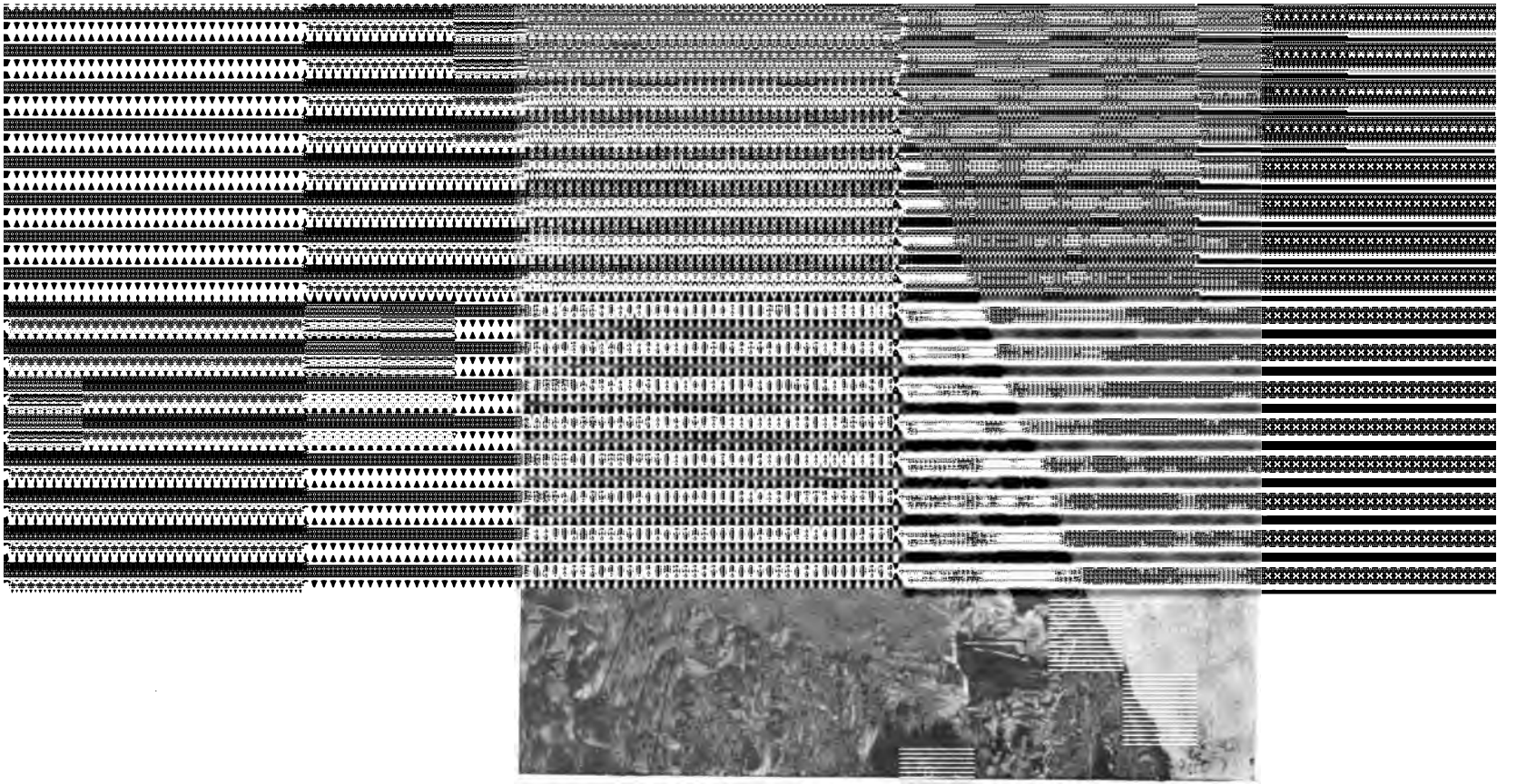
LAKE COUNTY.

Two Occurrences.—Limestone is found in the vicinity of the Abbott Quicksilver Mine, and also at Burns Valley, where the Sulphur Bank Mining Company has two limekilns.

MONTEREY COUNTY.

Nelson Creek.—Large bodies of crystalline limestone, free from impurities, outcrop along Nelson Creek, a tributary of Indian Creek. These beds are easily accessible by road from San Miguel, from which place they are distant 18 miles.

Rockland Lime and Lumber Company's Quarry.—On the coast of Monterey County, 30 miles below Point Sur, is an immense body of crystalline limestone extending down from the high mountains to within about a mile of the ocean, between the two branches of Milk Creek. Below one of the most prominent outcrops of this limestone four continuous kilns have been erected, and a road built down the creek



to the ocean. The limestone beds have been so crushed that no solid mass has been found; simply angular blocks of all sizes, great numbers of which have fallen at the base of the ledge. It is from these chiefly that the lime is made. In places the limestone is perfectly pure; in others it contains much mica and molybdenite, making it necessary to sort it for the kilns. The limestone is here in such quantity, and so convenient to the water, that it is difficult to see why the work has been abandoned. See our VIIIth Report, p. 410.

NEVADA COUNTY.

Several belts of limestone and marble are known in this county, and are worked on a small scale. The general trend is N. and S.

South Yuba Marble Company.—This property is situated in Sec. 18, T. 17 N., R. 10 E., 2 miles S.W. from North Bloomfield, on the South Yuba River, in North Bloomfield Mining District. It consists of three claims on the river between Edwards' and Purdon's bridges, near where Humbug Cañon enters the South Yuba, each claim consisting of 1,500 by 600 ft. The principal limestone belt, which is about 600 ft. wide where it crosses the river, has a N. and S. course and crops out most prominently on the S. side. The other two claims are half a mile farther down the river, the limestone showing a more N.E. trend. It lies 6 miles from the Colfax and Nevada Narrow Gauge Railroad, and will require the building of a rather expensive road. The following varieties of marble can be obtained: Black, mottled, and variegated, which take a high polish. At present 5 men are employed. W. H. Kallenberg, of North Bloomfield, owner.

RIVERSIDE COUNTY.

Colton Quarry.—The California Portland Cement Company, of Los Angeles, is quarrying marble for buildings and curbstones, and also for making macadam, at their quarries near Colton. The marble is also ground and sold for the manufacture of carbonic acid gas by soda works.

San Gorgonio Pass.—A large ledge of handsome white marble occurs a few hundred yards west of the line of the S. P. R. R., at the foot of San Gorgonio Pass, a short distance below Whitewater Station. The ledge is 60 ft. in width. It is entirely undeveloped. Some of the marble is fine-textured and as white as snow. The greater portion is rather coarse. It is often banded and blotched with bluish streaks and spots.

SAN BENITO COUNTY.

Cienega Lime Company's Quarry.—This quarry is about 7 miles S. of Tres Pinos, on the northeastern slope of the Gabilan range. The limestone is generally a coarse crystalline variety, quite pure and clear. Portions are very compact and fine-grained, being suitable for use as marble. The color is pure white. Large blocks can be obtained and the quantity is unlimited, for the ledge extends in a N.W. direction, more or less broken, to and past Fremont Peak. There are four continuous kilns on the property. See our VIIIth Report, p. 488. O. W. Tupper, of San José, Superintendent.

SAN BERNARDINO COUNTY.

In Bear Valley Region deposits of excellent marble occur.

The Gem Quarries, near Victor, are well known as producers of an excellent quality of fine variegated marble.

Near the Black Hawk Mines, 18 miles E. of Rabbit Springs, there occurs a very fine white, fine-grained marble.

SAN LUIS OBISPO COUNTY.

E. Smith's Property.—It is 3 miles N.W. of Adelaide P. O., and is a great mass of Tertiary limestone. In past years much lime of an excellent quality has been produced here.

Ten miles N.W. of Paso Robles is another limestone bed. It is 100 ft. thick and of the same age and character as that just mentioned.

SANTA CLARA COUNTY.

In former years considerable quantities of lime were made in the vicinity of Los Gatos and near Guadaloupe, but the industry has long since been discontinued, owing to the frequent and increasing occurrence of flinty nodules in the limestone, the entire mass of lime rock becoming finally too silicious to make good lime.

Wright's Ranch.—On this ranch, 5 miles S.E. of the New Almaden Mine, is a large and valuable deposit of marble. It contains none of the flinty nodules or secretions of quartz commonly observed in marbles. Its color varies somewhat, light shades of gray, occasionally tinged with red or brownish shades, predominating. Some portions are nearly white, but it is mostly mottled or curiously marked by blotches and streaks of light shades in the darker crystalline ground-mass. The marble takes a high polish and is firm and free from flaws. But very little has been done to develop this deposit of marble, which outcrops from 60 to more than 100 ft. in width, standing above the surface in several places from 10 to 30 ft. nearly vertical, and extends continuously for over 3,000 ft. On the surface exposures there are the usual number of cracks and checks, but there is no doubt that blocks of large size may be quarried absolutely free from flaws, and that masses of marble may be produced larger by far than can be shipped from the quarry in single blocks. When connected with the railroad this property is destined to become valuable.

SANTA CRUZ COUNTY.

The crystallized lime rock (marble) on Medar Creek, near the bridge on the county road, promises the best of any observed in Santa Cruz County, but the exposures are only those made in grading the road at the place mentioned. The marble occurs on both sides of the granite uplift, at an altitude of about 900 ft., extending in an almost unbroken line for 12 miles on the northwest side. On the east side the largest mass is only 2 miles long, lying between the Santa Cruz and San Vicente creeks. On the northeast it occurs in a considerable mass near the town of Felton, but it is not suitable for building material.

Within 2 miles of Santa Cruz City, in a N.W. direction, are a number of quarries of lime rock which is used for macadam, ashler, curbing,

and concrete foundations. The limestone is coarsely crystalline, and while a marble in fact, it is too loose grained, and from great movement and pressure has assumed a semi-schistose structure which causes it to scale off in slabs from the larger blocks. It is exposed to a depth of 25 ft. in one quarry, and is found resting on a glaucophane schist, somewhat crumbled and interstratified with limestone, probably the result of infiltration or replacement. Small bunches and irregular veins occur in the schist, containing finely disseminated iron sulphide, said to assay in silver a few ounces to the ton.

I X L Lime Company burned at the Felton kilns, in 1893, according to the Superintendent's report, 50,000 bbls. of lime, employing in the quarries, at the kilns, wood-chopping, teaming, etc., 50 to 55 men.

Louis De Dero Quarry.—It is 1½ miles N.W. from the business portion of Santa Cruz. During the summer months 20 men are employed at the quarry, and 20 to 25 more in teaming and other work indirectly connected with the quarry. Immediately under the limestone ledge, at its contact with the glaucophane schist, there are two large springs of beautifully clear water. As these springs are at an altitude of something like 200 ft. above the city of Santa Cruz, the supply could be utilized for water power.

Santa Cruz Quarry.—Near the above quarry, but a little N.W., is a quarry of coarsely crystallized carbonate of lime that makes a lime of good quality. Six kilns are in operation most of the time, giving employment to about 175 men; 8 to 10 men are employed in each of the working quarries, and a considerable number in transporting the rock to the kilns; a large number also in cutting, hauling, and handling wood, and still others in teaming between the storehouses at the kilns and the railroad.

Thurber Quarry.—This is situated in a field adjoining the De Dero quarry. This quarry employs 5 men at present, but a larger number of men find work during the summer months.

W. T. Holmes Lime Company.—This company has three continuous and seven ordinary kilns. In 1893 they burned 70,000 bbls. of lime, employing 12 men in the quarry, 30 about the kilns, and 40 in cutting wood, making staves, and in teaming; total, 82 men. None of the lime rock quarried here is used for other purposes than making lime. It is too much shattered for structural purposes and there is no demand for macadam. A branch railroad runs from the main line of the narrow gauge to the Holmes lower kilns and to the town of Felton for the economical handling of the lime.

SHASTA COUNTY.

Backbone Creek.—Near here is a deposit of limestone, where an excellent quality of lime is made.

McCloud River.—Great beds, almost 1 mile wide, are found between Squaw Creek and Pitt River, bearing N.W. up to McCloud River.

SOLANO COUNTY.

Dicky's Quarry.—On a ranch 3½ miles N.E. of Suisun is this quarry, the product of which is shipped and used for flux in the smelting furnaces at Vallejo Junction. It produced last year 5,060 tons, and is worked only during the summer months.

SONOMA COUNTY.

Geyserville.—Limestone is found and has been quarried 7 miles N.W. from Geyserville, where two kilns were built. The lime, it is said, does not retain its white color, hence is unsuitable for plaster. The quarry is not being worked.

TUOLUMNE COUNTY.

Columbia Marble Company.—It has opened several quarries 2½ miles from Columbia. The product varies in texture from extremely fine statuary marble to a rather coarse limestone; in color it ranges from white to nearly blue-black, some being mottled and some banded. It dresses well, has no detrimental inclusions of quartz, and takes a high polish. The cutting works are located at the quarries. At present filling orders for local consumption constitutes the bulk of the business.

Sonora Quarries.—At several points near Sonora small quarries are opened, where a limited amount of marble is taken out and dressed for the local market.

PAVING-BLOCKS.

CONTRA COSTA COUNTY.

There are quarries in the hills between Concord and Clayton, about 6 miles N.W. of Mount Diablo, where formerly paving-blocks were made, but for several years past nothing has been done at these places.

MARIN COUNTY.

De Long Quarry.—It is on the F. C. De Long estate, near Novato.

Joseph Taylor Quarry.—It is located near Novato, and was working 8 to 10 men in April, 1894.

Paving-Block Quarry.—It is near Green Brae, and was operated some time since, but work has been suspended for several years.

SONOMA COUNTY.

The quarrying of paving-blocks is an important industry of this county, and gives employment to several hundred men even in ordinary times, while in a busy season more than a thousand men are employed. The principal quarries are near Santa Rosa, Sonoma, and Petaluma. The rock quarried for paving-blocks is erroneously called basalt. It is a dark gray trachyte, which covers 200 square miles of the eastern portion of this county. The lower portion is usually a heavy deposit of tufa of varying shades, though usually white. This succeeds in many places to a brick-red, porous, tufa-like rock, overlaid by massive, crystalline volcanic rock of dark-blue or gray color.

Barnes Quarry.—This is 2 miles E. of Penn's Grove Station. Two men are employed.

Borg Quarry.—It is near Melitta. There are 18 to 50 men employed. In 1893 this quarry shipped 240,000 blocks, and has now 6,000 on hand.

Clute Quarry.—It is E. of Santa Rosa. This quarry employs 20 men, who in 1893 made 150,000 blocks, of which 100,000 were marketed.

Cooney Quarry.—It is 5 miles N.E. of Petaluma. Two men are employed.

Cronin Quarry.—It is 1 mile S.E. of Petaluma. Worked intermittently.

E. W. Davis Quarry.—It is 2 miles E. of Penn's Grove, and employs 8 men.

Dickinson Quarry.—It is on the Dickinson ranch, 5 miles N.E. of Petaluma.

Harney Quarry.—It is between Santa Rosa and Melitta. From 7 to 25 men are employed. There were 65,000 blocks shipped in 1893, and 100,000 are now on hand.

Landgren Quarry.—It is between Santa Rosa and Melitta. Five men are employed. In 1893 there were made here 80,000 blocks, 20,000 being shipped.

Lester Harding Quarry.—It is 5 miles N.E. of Petaluma, and employs 2 men.

Manuel's Quarry.—This is one of a number of paving-block quarries situated along the line of the S. F. & N. P. R. R., between Santa Rosa and Kenwood Station. It employs from 20 to 30 men. In 1893 this quarry produced 400,000 blocks and shipped 100,000.

P. Maramora's Quarry.—This is at Kenwood, and employs 8 men. There were 60,000 blocks shipped in 1893, and 40,000 are now on hand.

Maroni Quarry.—Located at Kenwood. Six men are now employed, though at times a greater number. No blocks were shipped in 1893, but there are 40,000 on hand, which were about to be loaded on the cars in April, 1894.

Pinelli Quarry.—This is on the Vallejo estate, half a mile N.W. of the town of Sonoma, and produced in 1893 about 200,000 blocks. There are now on hand ready for shipment 130,000 blocks. This quarry also produces building-stone. In the spring of 1894 there were 6 men employed. At times in 1892 and 1893 about 40 men found work here.

Roberts Quarry.—It is 2 miles E. of Penn's Grove Station. There are 12 men employed.

Schocken's Quarries.—They are on a hill N. of Sonoma, overlooking the town, and are the largest in the district. There are employed at present 40 men, and at times 60 or more. These quarries in 1893 produced 600,000 paving-blocks, which were mostly shipped to San Francisco and Oakland.

Stacy Quarry.—Located at Kenwood, and is idle at present, though last year 20 men were employed. During that year 25,000 blocks were shipped, and there now remain on hand 150,000 blocks.

Thomason's Quarry.—It is owned by E. R. Thomason, of San Francisco, who employs 30 men. During 1893 over 300,000 blocks were made here, of which 100,000 were marketed.

G. Violette's Quarry.—This is at Melitta, but is not at present in operation. In 1893, 40,000 blocks were shipped; there are now on hand 100,000.

Weyl Quarry.—This is situated 1 mile N. of the town of Sonoma. Six men are employed at present, but at times 25 to 30 men find employment.

Wilkinson Quarry.—This is situated 2 miles E. of Penn's Grove Station, between Santa Rosa and Petaluma. At present it employs 3 men.

The price paid for these blocks is $32 per thousand at San Francisco

for street blocks, and $41 for a larger block known as the "specification" block. The cost of making the latter is $18 to $20 per thousand, and the transportation by wagon is $3 to $3 50 per thousand, and by rail $16, making a total cost of about $37 to $39 50 per thousand. By this it will be seen that competition is close and the margin of profit small.

SANDSTONE.

COLUSA COUNTY.

Sites Quarry.—This is situated about three quarters of a mile E. of Sites. The plant consists of a Sargent and an Ingersoll drill, a steam channeler, two gang saws, and a hoist, all run by steam power. This quarry is said to furnish about 40,000 cu. ft. of dressed stone a month. Formerly known as the O'Neil & Abbot Quarry. See our XIth Report, p. 188. Sites Sandstone Company, of 315 Montgomery Street, San Francisco, owners; J. N. Burns, of Sites, Superintendent.

CONTRA COSTA COUNTY.

Martinez Quarry.—Sandstone suitable for building is not abundant in this county, but on the ranch of James Rankin, at Martinez, is a stratum of sandstone which years ago was quarried to obtain the trimmings for the Napa Insane Asylum, and also for the construction of several buildings in Martinez, one of which is more than forty years old. It shows no deterioration by weathering, and is really a handsome stone. In color the rock ranges from buff at the surface to gray beneath, and finally shading into bluish-gray. It resembles the stone obtained in the Farwell Quarry, in Alameda County, near Niles Cañon. The rock is quite massive, and its appearance suggests the possibility of obtaining large-sized blocks at no great depth. The quarry has not been worked in many years, strange to say. Its close proximity to economical transportation by water would seem to make this quarry valuable. The rock is free, as far as observed, from flinty masses and inclusions of clayey material, while iron nodules are entirely absent.

McNear's Quarry.—This is on the line of the S. P. R. R., between Martinez and Port Costa, and not far from the Nevada Dock warehouses. There has been quarried a quantity of sandstone which was used in constructing two office buildings at Port Costa. An examination of the stone in the buildings showed it to be rather soft and to contain many small nodules of iron, which decay and fall out. This particular stone is not suitable for use in large buildings where great weight will come upon the lower portion of the walls.

Oakland Rock Company's Quarry.—A new concern has a quarry in this county about 10 miles N. of Oakland and a mile from the line of the California and Nevada Railroad. In April, 1894, crushing works, having a capacity of 300 cu. yds. per day, were being erected, very little work as yet having been done in the quarry. The material from this quarry will be used for macadam and concrete work. A force of 50 or more men will be required when the crushing plant is in operation.

HUMBOLDT COUNTY.

Jacoby Creek Quarry.—This large sandstone quarry is in active operation, the rock being used for the breakwater at the mouth of Humboldt Bay. Last year 74,000 tons were shipped, mostly in pieces measuring more than a cubic yard in bulk. Arrangements have been made to take out 100,000 tons in 1894. There are 150 men employed; their average earnings are $1 75 per day. Small portable hoists are used to move and load the rock.

LAKE COUNTY.

Middletown Quarry.—For building purposes, suitable rock has been obtained from a low range of hills near Middletown.

NAPA COUNTY.

Situated in Gordon Valley, 11 miles E. of Napa, is a dark gray, even-grained rock.

SANTA CLARA COUNTY.

There are several quarries 7 miles from San José, on the branch railroad running to New Almaden. The station is called Graystone. The rock from these several quarries is similar, being a rather coarse-grained, buff to yellowish-gray stone, the better quality of which makes a handsome and apparently durable building-stone.

Flynn Quarry.—It is on the Seales estate, 2½ miles above Hillsdale, on a branch of the New Almaden line. It has never been opened extensively. The stone is of good quality, however, and will no doubt in time become valuable.

Gay Quarry.—It is 3 miles S. of San José. The rock quarried here is partly in the form of rectangular paving-blocks, and partly broken rock for macadam. There are 12 men employed at present.

Goodrich Estate Quarry.—This is the largest quarry and the only one working at present, and is commonly known as the *Graystone Quarry.* The works consists of two gangs of saws; the cutting and finishing department is at the station. The quarry is half a mile distant, on a spur track. The stone lies in quite uniform stratum, 10 to 18 ft. in thickness, dipping 15° to 20° S.E. During 1893 about 18,000 cu. ft. of stone were quarried, furnishing stone for the new Post Office in San José, the Oakland High School, and the Moir Block in San José. At the quarry 10 to 20 men are employed as required. At the works about 20 men are employed constantly.

Stanford Quarry.—It is just below Graystone Station, at the side of the railroad. It is a portion of the Goodrich estate, which was leased to Senator Leland Stanford, who took from it all the stone used in constructing the handsome Stanford University buildings. It has not been worked for more than two years.

Western Granite Company.—They opened a quarry about 2 miles above Hillsdale Station some time ago, and spent several thousand dollars in equipment. They quarried the stone used in the Ryland Block in San José, but finding that the stone did not come up to expectation abandoned the quarry.

SAN MATEO COUNTY.

Brittan Ranch.—Three miles N.W. of Redwood, and 1 mile from the railroad, is a quarry of the blue sandstone common along the Coast Range. It is highly metamorphosed. The quarry has been opened to furnish rock for building walls, chimneys, etc., and for concrete and macadam. It was not operated at all in 1893. On an eminence between the sandstone quarry and the railroad a quarry has been opened in the flint rock. This rock has also been used in making concrete, walls, and foundations.

SOLANO COUNTY.

In *Tolenas Cañon*, half a mile below the mineral springs, there are bowlders and croppings of a dark-colored sandstone which has every appearance of being suitable for building-stone, though at no place has a quarry been opened. Several pedestals are standing on the lawn at the Tolenas Springs House, which have been artistically cut and dressed, and which, it is stated, were made from bowlders found at the place indicated; these monuments have stood there several years, and show no sign of decay from exposure to the weather.

SONOMA COUNTY.

Coast Bluffs.—Along the bluffs on the coast from Fort Ross to Stewart's Point, sandstone has been quarried and proved a good building material; the bluffs can be approached by schooners.

SLATES.

Although there are extensive belts of slate throughout the State, some of which can be used with advantage for the purposes where in the building trade, or arts, slate is desired, the only developments to date of such deposits are in El Dorado County. There the quality of the material is of the very best.

EL DORADO COUNTY.

A blue-black, finely laminated slate strikes through this county with a general N.E. and S.W. course, standing nearly vertical, and closely following the "Mother Lode." It has been mostly developed along Big Cañon, that runs north down to Chili Bar, and has been traced across the Georgetown Divide to the vicinity of Volcanoville. The peculiar features of this slate are its extreme elasticity, and the fact that it has no developed fracture planes, further than its extremely fine grain, and also that after a forty years' test it is found to retain its original color with no signs of fading. In proof of its extreme elasticity, squares of slate split seven to the inch, and 18 in. square, have been fastened solid at the two ends and bent in the center 3 in., without showing the least sign of a fracture.

Chili Bar Slate Quarry.—This quarry is 3 miles N. of Placerville, in Sec. 36, T. 11 N., R. 10 E., and contains 40 acres of patented ground

facing the river, on the stage road between Georgetown and Placerville, at the Chili Bar bridge. The quarry presents a bluff facing the river 600 ft. in length and 200 ft. high, with an available belt of clear slate 97 ft. wide. At the east side the slate is traversed by small quartz seams. By the present mode of working, an average of 15 tons of slate have to be moved and handled to furnish 1 ton of marketable slate, but with improved appliances this waste will be greatly reduced. This waste can, by suitable appliances, be converted into a very good quality of bricks. The average present production is 1,200 squares per year. (A "square" signifies 10 by 10 ft.) The usual sizes produced are 12 by 6 in. up to 12 by 24 in., split five to the inch. In blasting the slate, a very slow-burning, coarse-grained powder is used, the holes being drilled at right angles to the splitting surfaces of the slate. The product from this quarry goes to the principal towns in the State. Ten men are employed. See our VIIIth and IXth Reports, pp. 199 and 283. J. G. Mothersole, of Placerville, owner.

El Dorado Big Tunnel Company.—This is really a gold mine, in which in driving a main tunnel they cut through the same belt of slate as that of the Chili Bar Slate Quarry. The available slate is 97 ft. wide, and at 250 ft. vertical depth from the surface shows an extremely fine texture. Steps are to be taken to work this slate body in connection with the mine. El Dorado Big Tunnel Company, owners; G. W. Campbell, of Placerville, Secretary.

San Francisco Slate Company.—This company controls 640 acres on the north side of the river, opposite Chili Bar. The quarries are in T. 11 N., R. 10 E., at an elevation of 150 ft. above the river. Two pits are being worked. The older pit is worked on a system of three benches of about 70 ft. face. An Ingersoll channeler for undercutting and two Ingersoll-Sargent machine drills are used; a compressor, run by water power from Kelsey Cañon, with a 250 ft. fall, using 40 in. of water, furnishes the required power. A large derrick used to handle the channeler, and a smaller one for handling the rocks, receive power from the same source. About 600 ft. of tramway connects the quarry with the two cutting machines. On the floor of the upper bench is a wire saw with an endless wire 1,400 ft. long. The second pit, situated one fourth of a mile up the river, has been but recently started and is at present 30 ft. deep. These works employ 23 men. San Francisco Slate Company, owners; J. R. S. Kymersley, of San Francisco, President.

El Dorado County slate is used on the following and other buildings:

At Bakersfield: New railway station and round-house.

At Berkeley: Deaf and Dumb, and the Blind Asylum.

At Glen Ellen: Home for Feeble-Minded Children.

At Ione: Preston School of Industry.

At Los Angeles: Whittier State School, and two large buildings.

At Napa: Masonic Hall, and new part of the State Asylum for Insane.

At Oakland: St. Mary's College; four school-houses; three churches; five private houses, and two buildings in Mountain View Cemetery.

At Ogden, U. T.: Union Depot.

At Portland, Or.: Three large commercial buildings.

At Sacramento: U. S. Government Building; Western Hotel; Buffalo Brewery, and five private houses.

At San Francisco: Buildings of the San Francisco Gas Company; Lick Baths; California Hotel and Theater; five churches; Cooper

Medical College; Lane Hospital; High School; block corner Mission and East Streets.

At San José: Hall of Records; State Normal School; one church, and one private house.

At Santa Barbara: One church.

At Stockton: Three churches; Court-house and Hall of Records, and two private houses.

By S. P. Company: Five large stations.

At Ukiah: State Asylum for Insane.

At Woodland: Two commercial buildings.

Private houses in Menlo Park, Merced, Woodland, Placerville, etc.

STEATITE AND SERPENTINE.

AMADOR COUNTY.

Serpentine is quarried near the Ione and Plymouth road, 1½ miles W. of the Central House, where a broad belt of serpentine striking N.W. crosses the road. Near the central area the rock seems to have preserved much of its original crystalline structure. In color the rock is yellowish-green to dark olive-green and brownish. It has a fine granular texture and takes a good polish. The quarry pit is only 40 by 20 by 15 ft. No work is in progress at present. Owned by Dr. Thomas Boysen, of San Francisco.

LOS ANGELES COUNTY.

Empire Landing Quarries.—These quarries are situated in the valley of the Pots, on Santa Catalina Island. The rock is steatite, and takes a fine polish. There are two varieties—a hard and a soft. The soft variety is sawed into slabs of any length. The hard variety is worked with ordinary stonecutter's tools. Two men are employed in this quarry. This stone has been used in several buildings in Los Angeles for ornamental, sanitary, and electrical purposes, also for lining fire-places and furnaces. The sanitary and electrical insulators manufactured from this stone are said to give the greatest satisfaction. The soft variety is supplied in slabs 1 in. in thickness, f. o. b. at Los Angeles, for 75 cents a running foot. The hard variety can be supplied in similar slabs at the rate of $2 50 a running foot.

Santa Catalina Island.—There is a large body of steatite on this island. It is said that about 400 tons of this rock is supplied every year to plasterers, soap factories, druggists, and foundrymen.

TUOLUMNE COUNTY.

Steatite is quarried at numerous places in this county, but so far only for local use. It has been used for foundations for boilers and in building chimneys, and at Chinese Camp for the walls of buildings.

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TRAVERTINE AND ONYX.

MONO COUNTY.

Travertine and "Onyx."—This deposit is situated about 1 mile S.E. of Bridgeport, and near the base of an extensive area of hilly country formed of hornblende andesite. Here four claims have been located in one block, but the most of the travertine is confined to two of them. The springs, which at one time were more numerous than at present, have built up a deposit of unknown depth, in what is apparently a basin-like depression; a large part of this mass consists of porous limestone, but in the center and eastern part deposits of a different kind have been formed. Here are eight distinct moles or ridges, seven of them nearly parallel, and built up from 10 to 25 ft. above the general level. Running longitudinally through each of these, and generally nearly vertical, is a fissure, sometimes open and nearly 2 ft. wide, and at others closed by a deposit of banded onyx (aragonite) or travertine. The outer portion of these ridges is formed generally of a somewhat shelly and porous lime deposit. The open cavities sometimes have a depth of 15 ft., and in them can be seen to advantage the character of the travertine. It would appear that the springs which carried the lime, magnesia, iron, etc., which was deposited to form the ridges were generally arranged along parallel fissures in the underlying rock. In places it would seem that as the ridges were built up the central fissure grew wider, and the deposition terminated with the filling of this central cavity by the travertine. In nearly all cases the travertine was formed in the vertical fissure, while the shelly layers of the lime adjoining were nearly level, sloping off on either side. One mole is still in process of formation. Numerous springs, varying in temperature from lukewarm to boiling, are scattered irregularly over the spaces between the ridges, but do not leave any deposits near their orifices, the lime and magnesia in the latter case not being precipitated immediately on reaching the surface. The outer portions of a number of the moles have been partly worn away. In one or two there are considerable quantities of magnesia and soda; the travertine in the center, being much harder, is not so easily eroded. The extent of the travertine and onyx is evidently considerable; no work has yet been done to show the depth to which they reach. In places it would appear that it must be more than 50 ft. Near the eastern edge of the deposit is a spring slightly impregnated with carbonic acid, the water being very pleasant to the taste. The great beauty of the travertine found here will undoubtedly bring a large amount of it into use. California Travertine and Onyx Company, of Bridgeport, owners.

SAN LUIS OBISPO COUNTY.

The so-called onyx deposits are described in our Xth Report, p. 584. No developments have been made since.

SOLANO COUNTY.

At *Tolenas Springs* occurs an extensive deposit of aragonite, locally called onyx, which is a calcareous travertine deposited from the mineral springs which abound in the neighborhood. Some of this rock is honeycombed from the action of carbonated water.

TRACHYTE, TUFA, AND VOLCANIC ASH.

AMADOR COUNTY.

Volcanic ash is used somewhat in building, but no quarries are regularly worked. Both white and red tufa are quarried in the Jackson Butte, 2 miles S.E. of Jackson.

CALAVERAS COUNTY.

Volcanic ash is quarried in a score or more places in this county. So abundant is good material of this description that quarries are opened at the nearest convenient places. There are several of these quarries about Altaville, and on the road from Angels to Vallecito and Murphys. This stone caps the channels of the ancient rivers, and is a volcanic ash, in which a process of crystallization has taken place. The rock varies in texture from a somewhat spongy, though firmly coherent, mass, easily dressed or sawed, and making a fine building-stone, to that having a fine-grained, felsitic texture, and ringing like pottery. That which is a medium between the two is preferred. It is fire-proof, and weathers well, and withstands moderate pressure. Some of the finest buildings in Angels, San Andreas, and Mokelumne Hill are constructed of this material.

LOS ANGELES COUNTY.

The Lang Quarry is situated on Santa Catalina Island. It is said that although this stone is admirably suited for building purposes, the greatest demand for it has been as rubble rock, for use in railroad construction and harbor improvements. It is stated that 150,000 tons of this rock have been used during the last fifteen years. This rock can be supplied f. o. b. at Los Angeles, at the rate of from $3 to $4 a cubic yard.

NAPA COUNTY.

Trachytic tufa is quarried in various places on the east side of Napa Valley for building purposes; also near Calistoga.

SONOMA COUNTY.

Agua Caliente Quarry.—Near Agua Caliente Post Office is a deposit of light-gray tufa, which has been used in the construction of local buildings, but not elsewhere, as far as was learned. It resembles the white tufa half a mile N. of the town of Sonoma, and is a portion of the same deposit. W. R. Cady, of Agua Caliente, owner.

Freestone Quarry.—Here a white ashy tufa occurs which has wrongly been named "freestone." A quarry was opened years ago on the ranch of James Kane, but the rock has only been used locally. The rock exposed to-day in the quarry is too soft for building-stone. The quarry has not been operated for years, and never except in a desultory way to supply the spasmodic local demand. James Kane, of Freestone, owner.

Maroni Quarry.—Near Kenwood Station, between Sonoma and Santa Rosa, a red lava occurs, which furnishes the rock for the Kenwood rail-

road station. Some of this rock has also been shipped to San Francisco. P. Maroni, of Kenwood, owner.

Stony Point Quarry.—A white tufa occurs near Stony Point, between Santa Rosa and Petaluma. It has been used in facing two buildings in Petaluma. The rock can be sawed when first quarried, but hardens on exposure.

Vallejo Estate Quarry.—On the ranch of the Vallejo estate, half a mile N. of the town of Sonoma, is a quarry of dark-red porphyritic rock, which has been used locally for building purposes. The rock is scarcely suitable to be used in the construction of tall buildings when great pressure and strain are likely to occur. The quarry also produces paving-blocks. There are 5 men employed at present; at times as high as 40 men have been at work in this quarry. A. Pinelli, of Sonoma, lessee.

Half a mile N. of the town of Sonoma is a deposit of light ashy tufa, which has been used locally for buildings, for curbing in the cemetery, and for rough walls. It is too soft to make good building-stone.

MISCELLANEOUS.

ASBESTOS.

SIERRA COUNTY.

The American Excelsior Consolidated Asbestos Company.—This property is situated on Goodyear Creek, half a mile W. from Goodyear Bar. There are five claims comprised in the property. This belt has a N. and S. course and has been traced for over a mile. The fiber in places can be obtained from 5 to 6 in. in length.

BARYTA.

SANTA BARBARA COUNTY.

A deposit of baryta occurs on the Sisquoc, about 15 miles S.E. of Santa Maria. No work has been done, and the extent and quality are not known.

DIATOMACEOUS EARTH.

LOS ANGELES COUNTY.

There is said to be a deposit of diatomaceous earth, about 75 ft. in thickness, on Santa Catalina Island. A few tons of this material have been sold to druggists.

EMERY.

SIERRA COUNTY.

Brandy City.—Near here, in Sec. 1, T. 19 N., R. 8 E., emery is found in bunches, but not in a continuous body. The difficulty of freighting hinders any active explorations for this mineral.

MINERAL PAINT.

SONOMA COUNTY.

Indian Metallic Red Paint Mine.—This is 7½ miles S.W. from Healdsburg, on Porter Creek, and comprises 160 acres of mineral land and a 40-acre mill site. The ore body, consisting of hematite and silicate of iron, has a N. of E. course, and crops out 60 ft. in width. The walls are a hornblendic rock with actinolite and mica schist, with rotten ser-

pentine on the foot-wall. A tunnel 70 ft. below the croppings has been driven 175 ft. to the vein, which it cuts, disclosing a solid mass of peroxide and silicate of iron, which is crushed, ground, and bolted in a mill supplied with four burrstones. About 8 tons of ore are worked per day, making a paint fit to mix with oils or japan. Steam power is used. Ten men are employed when running full handed. The ore assays from 60 to 75 per cent of iron. C. Merchant, of Healdsburg, owner.

YUBA COUNTY.

Mott's Ranch.—A ledge of mineral paint (red) has been found 6 miles N.E. from Brown's Valley, between Pain's Peak and Labadie Peak; it has a N. and S. course, and consists of peroxide and silicate of iron. The extent of the material has not been demonstrated; it crops out and is cut by a ditch on Mr. H. Mott's land.

The soil through this section of country shows the presence of large quantities of peroxide of iron.

NATURAL CARBONIC ACID GAS.

SANTA CLARA COUNTY.

Carbon Dioxide at New Almaden.—All are familiar with natural illuminating gas and its economic value, but it is only recently that the much dreaded choke-damp of coal miners—carbonic acid gas (CO_2)—has been turned to a valuable use in this State. This gas exists in greater or less quantity in nearly all mines, and more particularly in old workings. In a portion of the New Almaden Quicksilver Mine it is very abundant, and at the time the openings referred to were made, the flow of gas was so abundant that that portion of the mine was abandoned. This gas occurs in the Santa Isabel shaft and in a drift leading off from it. The shaft was sunk vertically 575 ft., and from that level a drift was run in 2,150 ft. The CO_2 was always troublesome, but as the distance from the shaft increased, the gas became stronger and stronger, until it was with difficulty the miners could work. At the face, 2,150 ft. from the shaft, a blast opened a reservoir of the deadly gas, which rushed in upon the miners, who were obliged to retreat before it. All ordinary means of getting rid of the gas having failed, a powerful air compressor was located at the shaft on the surface, and a vast volume of fresh, pure air was forced down into the mine, while at the same time an exhaust blower was draining the foul gas from the drift, but to no purpose. Lights would not burn and men could not live there, and the work was abandoned. At a point 845 ft. distant from the shaft a bulkhead of brick was built, the walls being double and 2 ft. apart. The middle space was filled with cement. A pipe was laid in this wall for experimental purpose probably. Recently an enterprising soda water manufacturing concern of San José has taken a long time lease on this reservoir of natural carbonic acid gas, and is now using it in the manufacture of mineral waters, ales, etc., and is also selling it to breweries. The gas is drawn from the pipe and forced into a large receiver, from which it is charged into steel cylinders, under a pressure of 1,300 lbs. to the square inch. The contents of one of the cylinders is equal to 1,200 gallons. In

this form the gas is shipped to any desired point. The cost is far below that of manufactured gas, evolved by the action of dilute sulphuric acid on marble dust. California Natural Carbonic Gas Company, of San José, lessees.

PECTOLITE.

TEHAMA COUNTY.

A deposit of this mineral is found in Sec. 16, T. 25 N., R. 7 W., M.D.M. This mineral deposit is situated at the contact of the serpentine and metamorphic shale. There are several outcropping masses, which appear to be distributed along a line which has a N.W. strike; one of these masses measures 8 by 10 by 20 ft. Much of this rock is white, and shows a slightly fibrous structure, and some of it appears to be intermixed with country rock. See also our Xth Report, p. 692.

PLATINUM.

PLUMAS COUNTY.

Platinum, with iridium and osmium, has been found, in small scales and grains, in conjunction with the gravels along Spanish Creek, Gopher and Badger Hill hydraulic mines; also in the gravel deposits of La Porte, and at Mumford, Shores, and Gopher hills, a few miles W. of Quincy.

TRINITY COUNTY.

It is found in small quantities in the gravel channels along Trinity River, more especially on the second bench. Also in small quantities in the gravels on Grizzly Gulch.

SALT.

ALAMEDA COUNTY.

The salt industry in the vicinity of Alvarado and Newark, on the east side of San Francisco Bay, was established in 1869, and is now one of considerable importance, the output reaching many thousand tons per annum, and giving employment to 120 men during summer months and about 20 the year around.

The process of salt-making, as practiced here, has been described in our VIIIth Report, p. 32. The method pursued at Plummer Bros.' Works being similar in all essential particulars to that of the others, it only will be described.

Originally the salt ponds or reservoirs were simply lagoons or indentations in the marshy coast of the bay. Across the inlets to these, embankments or dikes were constructed, being furnished with gates which could be opened or closed at pleasure. The interior portion was subdivided into several basins. The outer gates are opened with the incoming tide and closed at the flood, the receiving reservoirs being

full. From these large ponds, 50, 55, and 60 acres, respectively, the water is pumped by windmills into an interior pond, having an area of 40 acres, but of greater depth than the others. The receiving reservoirs are filled once a month. The water evaporates rapidly during the summer months, being assisted by a brisk wind which is almost constant at that point. When by evaporation the water has attained a certain density, it is pumped into a receiver, called the pickle lake, from which it is pumped later into the smaller lakes and vats, where the solution becomes saturated and salt is deposited. The liquor, called "bittern," is then drawn off and the salt shoveled out by the workmen and placed in large heaps under roofs in lots of 800 to 1,000 tons. The salt made here is very pure. The coarsely crystallized mineral is ground to varying degrees of fineness, depending on the purpose for which it is to be used. Table salt is ground very fine; that sold to packing-houses is quite coarse. A large amount of the bay salt is sold to the chlorination works in the gold-mining region of the State.

COLUSA COUNTY.

The Antelope Crystal Salt Company.—This was incorporated in 1890 to manufacture salt from brine springs on the Petersen ranch, near Sites. See our XIth Report, p. 180. The plant consists of 58 wooden tanks, 10 by 10 ft. by 6 in. deep, and 28 wooden tanks 10 by 10 ft. by 8 in. deep. Only a few tons of salt were manufactured in 1893 for local use. During June and July, 1894, Mr. Rusche, who leased the plant, manufactured several tons of salt. E. A. Harrington, of Colusa, manager.

RIVERSIDE COUNTY.

New Liverpool Salt Company's Works are near Salton, a station on the S. P. R. R., in the Colorado Desert, 155 miles S.E. of Los Angeles. The salt is obtained from the natural evaporation of the waters of Salton Lake, the mineral being scooped up and housed. A grinding-works and store-houses constitute the plant. See our Xth Report, p. 388. The New Liverpool Salt Company, of San Francisco, owners; G. W. Durbrow, Superintendent.

SAN BERNARDINO COUNTY.

Danby Salt Mines.—They are 30 miles S. of Danby, a station on the A. & P. R. R. The mineral occurs as rock salt of fine quality, the crystals being large and transparent. The salt is mined and hauled to Danby by steam wagons and shipped by rail. The mines comprise 160 acres. Crystal Salt Company, of 303 California Street, San Francisco, owners.

SODA.

INYO COUNTY.

Inyo Development Company.—The works of this company are situated on the shore of Owens Lake, 1 mile N. of Keeler. At the time of the Bureau's examination little work was going on, but during the summer a large body of men are employed. The method of obtaining the soda

from the waters of the lake was described by Mr. Goodyear in our VIIIth Report, p. 227. Inyo Development Company, of Carson, Nevada, owners.

SULPHUR.

Although there are several deposits of sulphur in California, at present there is no sulphur being mined in the State, owing to the cheapness with which a comparatively pure article is imported as crude Japanese sulphur.

COLUSA COUNTY.

Sulphur Creek.—There are deposits of sulphur both on the Moore property and at the Elgin Mine, in the Sulphur Creek Mining District.

KERN COUNTY.

Sunset Oil District.—In the Sunset Oil District, on the western side of Kern County, there are deposits of sulphur which altogether cover an area of several acres. Prospect workings which are 10 or 12 ft. deep have shown that these deposits are made up of both high- and low-grade sulphur ore. Some of it is nearly pure sulphur, but for the most part it consists of drift cemented with sulphur, or decomposed rock or earth permeated with sulphur. All these deposits are acid, and bituminous matter is associated with some of them. See our XIth Report, p. 233; also Bulletin No. 3, p. 34.

LAKE COUNTY.

Sulphur Banks Mine.—Sulphur was obtained in this vicinity in large quantities, but is not mined at present.

WATER.

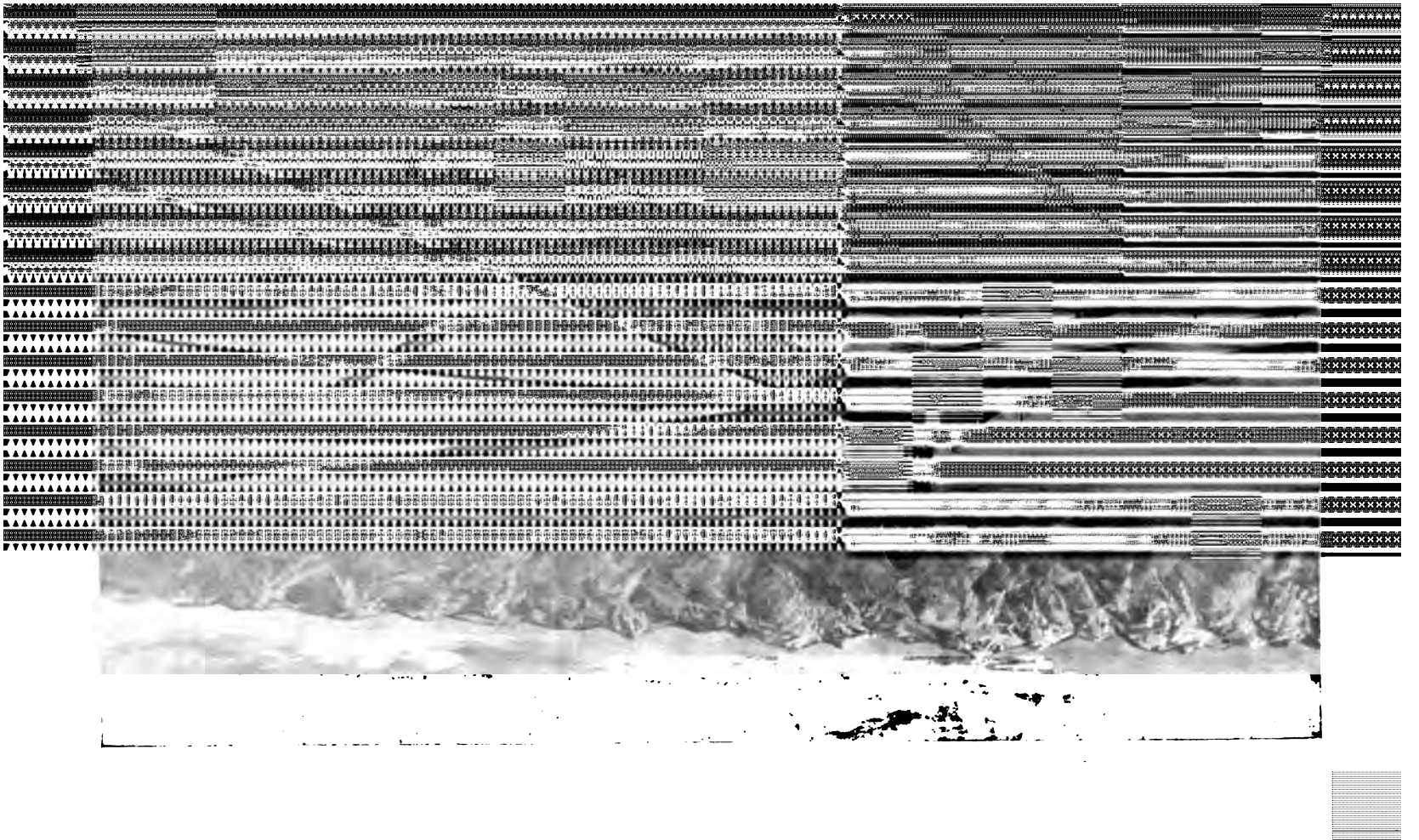
SACRAMENTO COUNTY.

Folsom Water Power Company.—The dam and power-house and the first section of the canal, mentioned in our IXth and Xth Reports, pp. 336, 511, and 512, have been completed. Wm. Knight, the resident agent of this company, states that the canal has been nearly completed, the distance being 9,100 ft. below the dam, with a cross-section of 8 by 45 ft. The canal and fore-bay are expected to be completed soon, and waterwheels and electrical generators placed in position early next year, the electrical current to be used for light, power, etc., in Sacramento.

STANISLAUS COUNTY.

Irrigation.—In 1893 a dam was built on the Tuolumne River by the Turlock and Modesto irrigation districts; it is of stone, 105 ft. high, and 310 ft. long on top.

Modesto Irrigation District.—The main ditch of this district has been completed from the dam to the eastern boundary of the irrigation district, a distance of nearly 23 miles. The head works and flumes



between the dam and Mill Gulch, a distance of about 4,000 ft., were to be completed this year. See our XIth Report, pp. 467 and 468.

Modesto Waterworks.—Owing to the fact that the old waterworks were situated in the most populous part of Modesto, new waterworks, owned by the city, have been established in the western outskirts of the town. At these works a shaft was sunk to the depth of 33 ft., in the bottom of which three wells were bored to a depth of 195 ft. below the surface of the ground. These wells are cased with 16 in. casing to a depth of 40 ft. from the floor of the shaft, and with 12 in. casing from the floor of the shaft to the bottom of the wells. The space between the 16 in. and the 12 in. casings is filled with cement. The water stands in the casing at a depth of 2 ft. below the floor of the shaft. It is said that continuous pumping lowers the water 24 ft., at which depth the water is stationary, although 700 gallons of water a minute have been pumped from the wells. Quicksand somewhat impedes the pumping. The pumping plant consists of two Hall's compound duplex direct-acting steam pumps, each of which is of 1,000,000 gallons nominal, and 800,000 gallons actual capacity for twenty-four hours. The pumps are run by a 40 horse-power engine and two 70 horse-power boilers.

Turlock Irrigation District.—The main ditch of this district has been finished for a distance of about 21 miles, and contracts have been let for the completion of the system. In July, 1894, about 200 men were employed. See our XIth Report, p. 467.

YOLO COUNTY.

A proposition is on foot to organize three irrigation districts in Yolo County under the "Wright Act." The water is to be obtained from Clear Lake, in Lake County.

ZINC.

SHASTA COUNTY.

Hobbs Mine.—This is 6 miles S.W. of Round Mountain. The vein courses E. and W., dipping about 60° S., between slate and granite walls. The ore body is in places 35 ft. wide, and contains finely divided zinc-blende, giving the ore at first glance the appearance of a granitic rock; it also carries some gold.

GOLD TABLE

Showing the Proportionate Weight of Gold in a Mass of Auriferous Quartz when the Specific Gravity is known.

Specific Gravity.	Proportion of Gold.	Specific Gravity.	Proportion of Gold.	Specific Gravity.	Proportion of Gold.
2.60	0.0000	4.20	0.4413	7.20	0.7402
2.65	0.0219	4.30	0.4580	7.40	0.7515
2.70	0.0429	4.40	0.4739	7.60	0.7622
2.75	0.0632	4.50	0.4892	7.80	0.7724
2.80	0.0828	4.60	0.5037	8.00	0.7820
2.85	0.1016	4.70	0.5176	8.50	0.8042
2.90	0.1198	4.80	0.5310	9.00	0.8239
2.95	0.1375	4.90	0.5438	9.50	0.8415
3.00	0.1545	5.00	0.5561	10.00	0.8573
3.10	0.1869	5.10	0.5679	10.50	0.8717
3.20	0.2172	5.20	0.5793	11.00	0.8847
3.30	0.2458	5.40	0.6007	11.50	0.8966
3.40	0.2726	5.60	0.6206	12.00	0.9075
3.50	0.2979	5.80	0.6392	13.00	0.9268
3.60	0.3218	6.00	0.6565	14.00	0.9434
3.70	0.3444	6.20	0.6727	15.00	0.9577
3.80	0.3659	6.40	0.6879	16.00	0.9706
3.90	0.3862	6.60	0.7021	17.00	0.9815
4.00	0.4055	6.80	0.7156	18.00	0.9912
4.10	0.4239	7.00	0.7282	19.00	1.0000

METHOD OF DETERMINING THE RESPECTIVE QUANTITIES OF GOLD AND QUARTZ IN QUARTZ SPECIMENS.

$$\frac{\text{Sp. g. Nugget} - \text{Sp. g. Quartz}}{\text{Sp. g. Gold} - \text{Sp. g. Quartz}} \times \frac{\text{Sp. g. Gold}}{\text{Sp. g. Specimen}} \times \text{Weight of Nugget} = \text{Weight of Gold in Specimen.}$$

$$\frac{\text{Sp. g. Gold} - \text{Sp. g. Specimen}}{\text{Sp. g. Gold} - \text{Sp. g. Quartz}} \times \frac{\text{Sp. g. Quartz}}{\text{Sp. g. Specimen}} \times \text{Weight of Specimen} = \text{Weight of Quartz in Specimen.}$$

First Example.—Suppose we have a specimen weighing 1,000 grains. and its specific gravity is found to be 8. Suppose, also, the specific gravity of gold were 18, and that of quartz 2, then, by above rule:

$$\frac{8-2}{18-2} \times \frac{18}{8} \times 1{,}000 = \frac{6}{16} \times \frac{18}{8} \times 1{,}000 = 843\tfrac{3}{4} \text{ grains of gold in specimen.}$$

$$\frac{18-8}{18-2} \times \frac{2}{8} \times 1{,}000 = \frac{10}{16} \times \frac{2}{8} \times 1{,}000 = 156\tfrac{1}{4} \text{ quartz in specimen.}$$

Second Example.—Nugget weighing 10 oz.; Sp. g. nugget, $8\frac{1}{2}$; Sp. g. gold, 19; Sp. g. quartz, $2\frac{1}{2}$:

$$\frac{8\frac{1}{2}-2\frac{1}{2}}{19-2\frac{1}{2}} \times \frac{19}{8\frac{1}{2}} \times 10 = \frac{6}{16\frac{1}{2}} \times \frac{19}{8\frac{1}{2}} \times 10 = 8.1283 \text{ of gold in specimen.}$$

$$\frac{19-8\frac{1}{2}}{19-2\frac{1}{2}} \times \frac{2\frac{1}{2}}{8\frac{1}{2}} \times 10 = \frac{10\frac{1}{2}}{16\frac{1}{2}} \times \frac{2\frac{1}{2}}{8\frac{1}{2}} \times 10 = 1.8716 \text{ quartz in specimen.}$$

ELECTRIC POWER TRANSMISSION PLANTS AND THE USE OF ELECTRICITY IN MINING OPERATIONS.

By THOMAS HAIGHT LEGGETT, of Bodie, Mono County, California.

Some one has aptly spoken of California as the Switzerland of America. Certainly the rugged scenery of its snow-capped Sierra, and its numerous lakes and mountain streams, justify, in part, the simile. In Switzerland they have been quick to realize the advantages to be derived from the utilization of their water powers for the generation of electric power, and its transmission to distant points; here, in California, we are but beginning to grasp the situation.

In electricity the miner has undoubtedly gained a most efficient and valuable ally. Through its aid the latent power of the many streams now running idly down the mountain slopes can be made available, and brought across long stretches of country by means of a simple line of wire, to operate the machinery of mine and mill.

In sections where no water powers are available, and fuel is scarce and dear, electricity may be generated at the center of fuel supply, and the power transmitted from this central station to operate a number of mills and hoisting works in the distant mining camp. One of the great advantages of electric power is its adaptability to ready subdivision into small units without material loss of power, by reason of the high efficiency now developed by the best types of dynamos. Hence, separate motors may be used in the mill for running crushers, stamps, concentrators, pans, etc., or in the mine for hoisting-engines, pumps, and air compressors, effecting a very appreciable saving when any of these machines are idle. To accomplish this requires the use of the direct current, but this can be readily obtained from the alternating where such is used for the transmission, by employing rotary transformers, or "motor generators," of high efficiency.

In a letter to the writer, accompanying photographs illustrating the Telluride, Colo., transmission plant, hereinafter described, Mr. Chas. F. Scott gives the following excellent résumé of the present status of electricity in the field of mining:

"In the introduction of electrical apparatus to the operations of the mining industries of the West, the field of electrical power transmission is extending upon lines which have already been well established in other industries. The electric motor is becoming an important factor in almost every industry in which power is utilized. One of the most notable instances is in electric traction. The electric street railway motor has not only almost entirely replaced animal power, but it has wonderfully increased the speed, comfort, and economy of street railway operation, and has also extended it to distances and classes of service which were previously impracticable. The early railway motor had many and peculiar difficulties to overcome, but the problems incident to it have been rapidly surmounted.

"Results similar to those which have been attained in street railway working are to be anticipated in the application of the electric motor

to the mining industry. Not only will the work which is now performed be done in many cases with increased ease and economy, but the introduction of the motor will lead to new methods of operation. Mining possesses many difficult and peculiar requirements for the application of power. The motor, on the other hand, possesses characteristics which render it capable of being adapted to a very great variety of conditions.

"The work which has already been accomplished in the new plants which have been installed, promises much for the future. The first work has been under difficulties which are incident to every new undertaking. The principal difficulties which have manifested themselves are, however, not fundamental ones; they are principally due to mechanical difficulties which are more or less readily recognized, and usually indicate a ready method of solution. A second trouble, which has promised at times to be very serious, is the effects resulting from the atmospheric conditions in the mining country. Lightning in many places has been extremely severe, and methods of protection were required which were impossible to devise before the conditions had been learned from experience. The necessity for protection has been followed by the means of protection, and electrical installations need no longer be in peril from lightning, if properly protected.

"The experience and progress which have come from other applications of electricity can be taken advantage of in application to mining work. The constant improvements and advances which are being made in the manufacture of electrical apparatus make it possible to secure at the present time apparatus which is better adapted for its work than could have been secured a few years ago.

"There is often an apprehension, on the part of those who are not familiar with electrical apparatus, that it is a fundamental failure if it does not at once begin and continue in satisfactory operation. Those, however, who are acquainted with electrical machinery, and who understand the nature of the difficulties which develop, may readily see that the fundamental elements in electrical power transmission and distribution are not involved in these difficulties, but that they arise from incidental features which can be readily corrected. The work which has already been accomplished shows the possibilities which are open in the field of electrical mining, and promises much for the future."

The transmission of 100 horse-power a distance of 109 miles, from Frankfort to Lauffen, Germany, in 1891, showed conclusively that from an engineering standpoint, at least, the transmission of power over long distances by electricity was perfectly practicable; though in this particular instance it was not a commercial success, nor was it intended to be, since the power was used for exhibition purposes only. Since then, however, plants have been installed both in Europe and in the United States, and are to-day successfully transmitting electricity for lighting and power purposes over distances ranging from 1 to 30 miles.

It will be proper to outline here the various methods of transmitting power over long distances by electricity, but for full information on this subject recourse must be had to the technical writers in the electrical journals and society transactions.*

*See W. F. C. Hasson's paper on "Electric Transmission of Power Long Distances," Transactions of the Technical Society of the Pacific Coast, Vol. X, No. 4; "Long Distance Transmission for Lighting and Power," by Chas. F. Scott, E.E., Vol. IX of Transactions of American Institute of Electrical Engineers; also pamphlet on Long Distance Transmission by L. B. Stillwell, E.E., issued by Westinghouse Electrical and Manufacturing Co., Pittsburg, Pa.

Power may be transmitted by means of electricity by—

1st. The direct or continuous current.

2d. The alternating current --
- (*a*) Single phase, 2-wire synchronous system.
- (*b*) Two-phase, 4-wire system. } Either synchronous or independent speeds of generator and motor, as desired.
- (*c*) Polyphase system; usually 3-phase with 3 wires. } Either synchronous or independent speeds of generator and motor, as desired.

The direct or continuous current has the advantage that the motors are self-starting, and at practically full torque, or turning effect. The motor speed is quite independent of that of the generator, though this is not necessarily an advantage, inasmuch as, in synchronous systems, the governing of the generator speed regulates that of the motor as well, and therefore attention to the speed of but one machine is all that is required.

Direct-current dynamos labor under the disadvantage of working under comparatively low potentials, since they require a commutator to change the alternating current they generate into a continuous one, *i. e.*, a current flowing constantly in one direction; and thus far it has been found impracticable to insulate this commutator for very high tensions. While it is asserted that* "direct-current machines of 5,000 volts are in regular and successful use for arc-lighting," it must be borne in mind that the requirements for furnishing light a limited number of hours each day are very different from the demands made upon electrical machines by a stamp mill or hoisting works, which require unintermittent operation, oftentimes including Sundays.

Hence, such a high-potential, direct-current machine, if in good running order to-day, would hardly be serviceable for long-distance transmission, and indeed the staunchest advocates of the direct current in this country have never installed such a machine for this purpose.

On the contrary, in several cases where electrical companies known to favor the direct-current system have had contracts for the installation of long-distance transmission plants, they have not attempted such, but have instead used an alternating-current system in every case where the distance exceeded three miles.

It is safe, therefore, to conclude that until these difficulties of commutator insulation are overcome,† this distance is the practical limit for direct-current transmission, unless a series arrangement of generators and motors be resorted to.

A low potential necessarily limits the distance of transmission, since the size of wire is directly proportional to the number of amperes of current to be carried; and since amperes times volts equals watts, of which 746 are equivalent to 1 horse-power, it follows that to transmit

* The "Electric Transmission of Power," Engineering Magazine, June, 1894, p. 393.

† Mr. E. H. Booth, in an article entitled "Electricity as applied to Mining Operations," published in "Industry" for June, 1892, says: "It is, however, a matter of difficulty to make commutators for potentials over 2,000 volts for direct-current generators, on account of the great number of segments required, and the difficulty of their proper insulation. While this voltage will be efficient and economical, both as regards cost of installation and of operation in many cases, conditions will also be met with requiring much higher voltages, which are at present commercially practicable only through the use of alternating currents."

100 horse-power, or 74,600 watts, a given distance at a pressure of 500 volts (the ordinary voltage of a direct-current dynamo), would require a current of 149.2 amperes, or a wire six times as large (sectional area six times as great) as that needed to deliver the same amount of power over the same distance at an electrical tension of 3,000 volts (25 amperes $\times$ 3,000 volts = 75,000 watts = 100 horse-power).

The series arrangement of generators and motors alluded to has been introduced abroad, notably in Switzerland, and brought there to a higher state of perfection than in this country. This application of the direct current for long-distance transmission requires a number of generators and an equal number of motors, making a complicated apparatus of excessive first cost, especially so since extra dynamos and motors must be provided; otherwise an accident to one machine disables the entire plant.

At Genoa, Italy, there is such a transmission at present in operation. The power transmitted is 300 horse-power over a distance of 18 miles. At the power stations, of which there are three, one below the other. there are four groups of dynamos, each group of two dynamos being driven by turbines (Piccard system) of 140 horse-power, working under heads varying from 225 to 495 meters.

These dynamos are connected in series, one group being held in reserve in case of accident to any of the others, and produce each a current of 47 amperes at 1,000 volts electrical tension, the resulting E. M. F. sometimes reaching 6,000 volts during the hours of maximum load. The motors are also connected in series, no one machine, it will be noted, carrying a potential exceeding 1,000 volts at any time. The power is utilized in operating a factory at the terminus of the line.

The lack of flexibility of the system and its inadaptability to a wide and varied range of work have often been spoken of by technical writers, and these disadvantages have prevented its successful competition with alternating-current systems for transmission—such as that from Niagara Falls to Buffalo, where the power is to be utilized for a great variety of work.

It has been cited as an advantage of the direct-current system that it is not liable to trouble from the static capacity and self-induction of the line occurring with the alternating-current. Self-induction will reduce the potential at the motor end of the line, while static capacity will act in the opposite direction and increase the E. M. F., thus tending to counteract the effect of self-induction.

The discussion of these technicalities can safely be left to the electricians, but the writer can state from experience with a transmission by the alternating-current synchronous system of 120 horse-power over a distance of 12½ miles that no trouble whatever has arisen from these causes. (See table showing the line-loss and the efficiency of this transmission.)

The three types of alternating-current machines, viz., the single-phase synchronous, the double-phase, and the three-phase generators, may, for purposes of comparison, be likened, respectively, to the single-cylinder steam engine, the double or two-cylinder engine with crank arms at 90°, and the three-cylinder engine with as many crank arms set at an angle of 120° each with the other; the electrical impulses bear just these relations with each other in the armature of the dynamo.

The single-phase generators and motors are necessarily synchronous,

and the latter are not self-starting, but must be brought up to the generator speed before the line current can be led into its armature; while the polyphase machines are self-starting under light load, but not under full load.

It is evident that for hoisting and similar work, where full load is thrown on the machine at once, alternating-current motors do not possess the advantages of direct-current machines, which start readily under such conditions, and for short periods can be greatly overloaded without damage.

If, therefore, it be desired to use electric power in all departments of a mining plant, the electricity being generated at a considerable distance from the works, cheapness of first cost and of copper conductors can be obtained by using a high-potential alternating system, with raising and lowering transformers if necessary; while by using rotary transformers, or motor generators, as they are sometimes termed, at the delivery end of the line, direct current can be obtained for all work requiring self-starting motors. These machines used for transforming alternating current into direct current at various potentials have a common field, and two windings upon the armature revolving within it, one of which receives the alternating current and acts as a motor, while the other generates the required direct current.*

For long-distance transmission the alternating current possesses the great advantage of being convertible from a low to a high potential, or vice versa, by means of a simple transformer, without moving parts, thereby effecting a great saving in copper, since, as already shown, the greater the E. M. F. the less number of amperes of current required to transmit a given power, and hence the smaller wire demanded. Single-phase, alternating-current motors, while not self-starting, may be heavily overloaded without pulling them out of synchronism and causing them to stop; and should the latter occur, no damage will result under ordinary conditions, since the self-induction of the armature will hold back the current for several minutes. They may be also heavily overloaded immediately after synchronizing. The 120 horse-power motor in the mill of the Standard Consolidated Mining Company at Bodie, Cal., has started all twenty stamps while resting upon the cams, though this, of course, is not the ordinary way of taking up the load. It shows that the motors will take an abnormally heavy load at the outset without damage beyond a little extra sparking at the commutator.

The two-phase four-wire system is equally adapted for both lighting and power, and it is not necessarily synchronous, though the advantage of speed regulation previously referred to makes it advisable to so operate the generator and motor wherever possible. It will furnish power through motors of either the rotating-field type (*i. e.*, rotating magnetism) or the polyphase; and by means of commutating devices

* Induction motors (three-phase) are now being built by the General Electric Company, and quarter-phase machines by the Westinghouse Electric and Manufacturing Company, which it is claimed are fully equal in every respect to direct-current machines. This is a development only to be expected in view of the fact that the best electricians in the country have been devoting their best energies to the attainment of this most desired result; and it will greatly simplify any quarter-phase or three-phase transmission plant where the power is to be used for the various classes of work required in mining.

it can be made to supply direct current for all power and lighting work if so desired, and at a very high efficiency of transformation.

It is therefore particularly well adapted to mining requirements, which as stated, demand motors starting immediately and with full torque for certain classes of work.

"There are two especially prominent types of these machines. The first of these, the double machine, has two fields and two armatures, the latter mounted on the same shaft. Each armature delivers alternating current to a two-wire circuit, and these circuits taken together constitute the four-wire circuit of the generator; or they may be so connected as to constitute a three-wire circuit.

"Machines of the second type have single armatures with two windings, or with a single winding so connected to the ring collectors as to deliver two currents differing in their time relation or phase."*

Twelve machines of the first type and of 1,000 horse-power capacity were used by the Westinghouse Electric and Manufacturing Company as single-phase generators for lighting purposes at the World's Fair. Some of these were used for power to run exhibit motors, and in these cases were connected as quarter-phase (two-phase) machines.

There is a decided advantage in this system over the three-phase in the distribution of load on the two circuits of which it is composed, as the machine can be designed to regulate each current independently, *i. e.*, maintain a constant E. M. F. with varying loads on the circuit, which cannot be done with the three-phase system.

This advantage largely offsets the saving in copper of the latter system, which saving can be put roughly at about 25 per cent over that of either the single two-wire or two-phase four-wire systems. These latter stand on about an equal footing as regards the amount of copper required for transmitting power over a given distance at a stated potential.

"In a paper read before Section 'G' of the British Association, on September 18, 1893, Mr. Gilbert Kapp makes the following statement: 'If we put all the systems on the same footing as regards efficiency and safety of insulation, we find the following, viz.: For the transmission of a certain power over a given distance * * * the single-phase alternating and the two-phase four-wire system will require 200 tons, the two-phase three-wire system will require 290 tons, and the three-phase three-wire system only 150 tons. As far as the line is concerned there is thus a distinct advantage in the employment of the three-phase system.' "†

For the amounts and cost of copper required for transmitting power over varying distances and under different potentials, the reader is referred to the papers by Messrs. Hasson and Stillwell, already cited.

From the foregoing it would appear that for the ordinary work of stamp mills, where single large units of power are chiefly needed, the single-phase synchronous motors are well adapted to meet all requirements where the power is transmitted from a distance too great for the use of the direct current; while for a more extended and varied use of

*From "Transmission of Power," a pamphlet issued by Westinghouse E. & M. Co., and prepared by L. B. Stillwell, E.E.

† "The Electrical Engineer" (N. Y.), January 17, 1894, p. 42.

such power the polyphase systems are more economical and comprehensive, more especially the two-phase four-wire method.*

In the paper by Mr. E. H. Booth, already referred to, he speaks of the use of separate motors for each stamp battery, and for groups of four pans and two settlers each, thus doing away with heavy and expensive line-shafting, belt alley-way, etc.

Such an extreme subdivision of the power, however, would result in a heavy loss of efficiency, and is further highly impracticable at present on account of the high speeds at which electric machines operate, necessitating counter shafting to reduce the revolutions to the slow speed of pan and cam shafts.

It is better, therefore, for milling work, to use a single large motor to operate the stamps, pans, etc., with perhaps one or two small ones for rock-crushers and concentrators in cases where the cost of the power or the production of higher-grade concentrates makes this an object.

The following description of the power-transmission plant of the Standard Consolidated Mining Company, at Bodie, Cal., is taken from the writer's paper read before the American Institute of Mining Engineers at the Virginia Beach meeting, February, 1894:

THE ELECTRIC POWER TRANSMISSION PLANT OF THE STANDARD CONSOLIDATED MINING COMPANY.

At Bodie, Mono County, Cal., the ruling price for wood has been, for years past, $10 per cord, so that the monthly fuel bills of a 20-stamp mill, crushing and amalgamating 50 tons of ore per day, would often amount to $2,000. To reduce this excessive cost of motive power was the problem in hand, and the use of electricity generated by water power has solved it. No sufficient water power could be found nearer than 12½ miles, the distance from Bodie in a straight line over the hills to the east flank of the Sierra Nevada. This distance is just at that intermediate point where the cost of transformers about equals the difference in cost between a No. 1 and a No. 6 copper wire (it is not advisable to use any lighter wire than No. 6, on account of its liability to rupture during storms). Hence it was deemed better not to use converters, since they would only complicate the apparatus, without effecting a saving in cost.

Water-Power Plant.

An excellent water power was found in a mountain stream on the north slope of Castle Peak, in the Sierra Nevada, known as Green Creek, and forming one of the chief sources of the East Walker River. This stream carries 400 in. of water during the dry season, and ten times that amount during the time of melting snows.

An old ditch was cleared out and rebuilt for a length of 4,570 ft., and a site was selected for a power-house 355 ft. vertically below its lower

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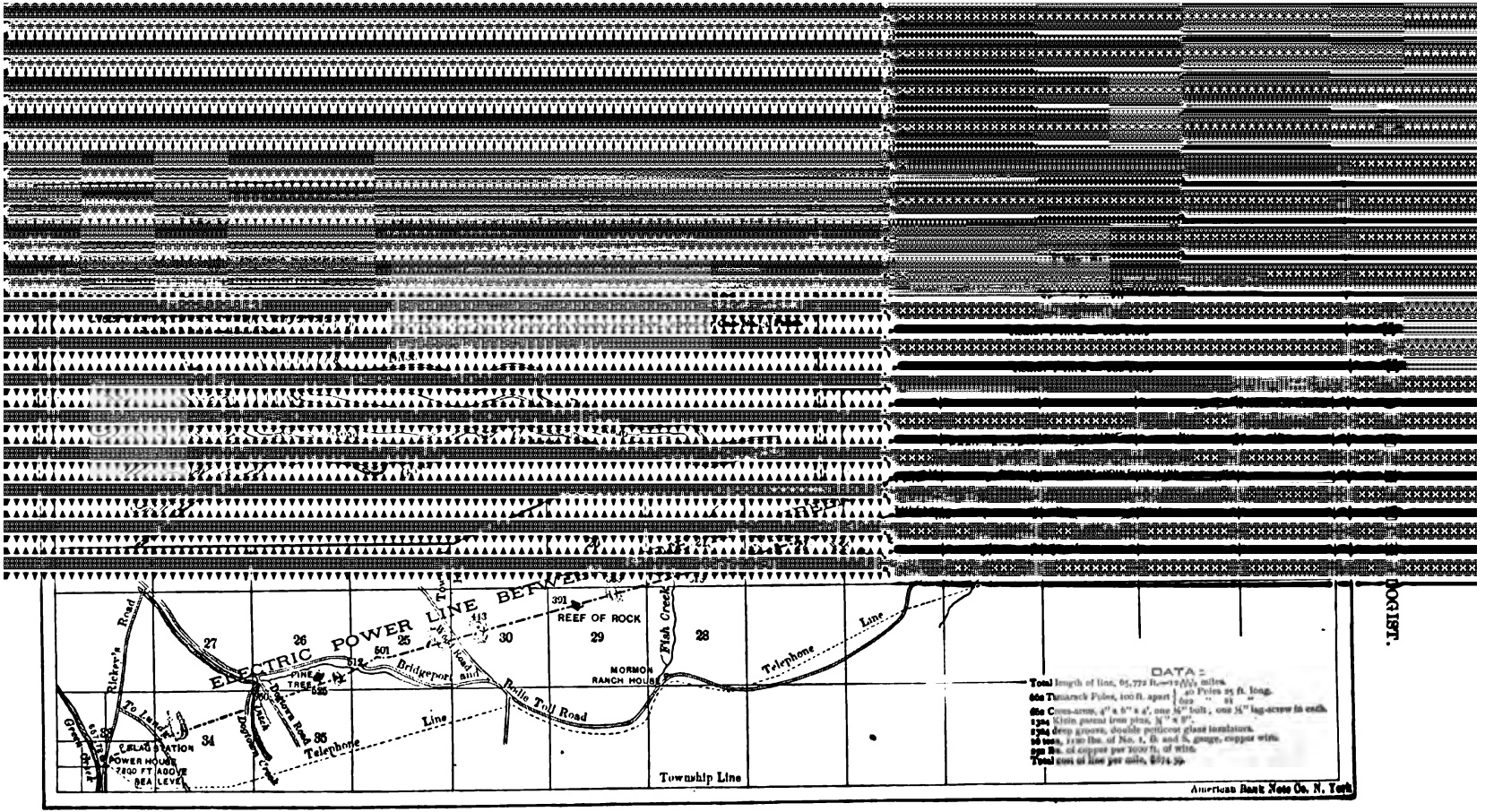
*For a full comparison of the relative advantages of the two-phase and the three-phase circuits, see "Polyphase Transmission," by Chas. F. Scott, in the "Electrical Engineer" (N. Y.), March 21, 1894. In this article Mr. Scott proposes a combination of the two-phase and three-phase systems, generating under the first system, and by means of special transformers (while also raising the potential if so desired) changing to the three-phase for the transmitting line and again converting to the two-phase current at the delivery end of the transmission, thereby uniting the advantages of saving in copper, of the one system, with those of greater simplicity, less cost of apparatus, and better regulation of the other method (the two-phase).


ELECTRIC POWER LINE BETWEEN
Bicker's Road
27
26
25
30
29
28
391
REEF OF ROCK
Fish Creek
Telephone Line
Bridgeport Road
Pedlie Toll Road
MORMON RANCH HOUSE
PINE TREE
To Lerdo
Dorsey Creek
Green River
34
35
Telephone Line
RELAY STATION
POWER HOUSE
7890 FT ABOVE SEA LEVEL
Township Line
DATA:
Total length of line, 65.772 miles.
660 Tamarack Poles, 100 ft. apart } 40 Poles 25 ft. long.
660 " " " 25 " "
660 Cross-arms, 4" x 5" x 4', one ½" bolt, one ½" lag-screw in each.
1320 Klein parcel iron pins, ¾" x 9".
1320 deep grooves, double petticoat glass insulators.
10 tons, 1020 lbs. of No. 1, 0, and 8, gauge, copper wire.
220 lbs. of copper per 1000 ft. of wire.
Total cost of line per mile, $274.39.
American Bank Note Co. N. York

DOGIST.

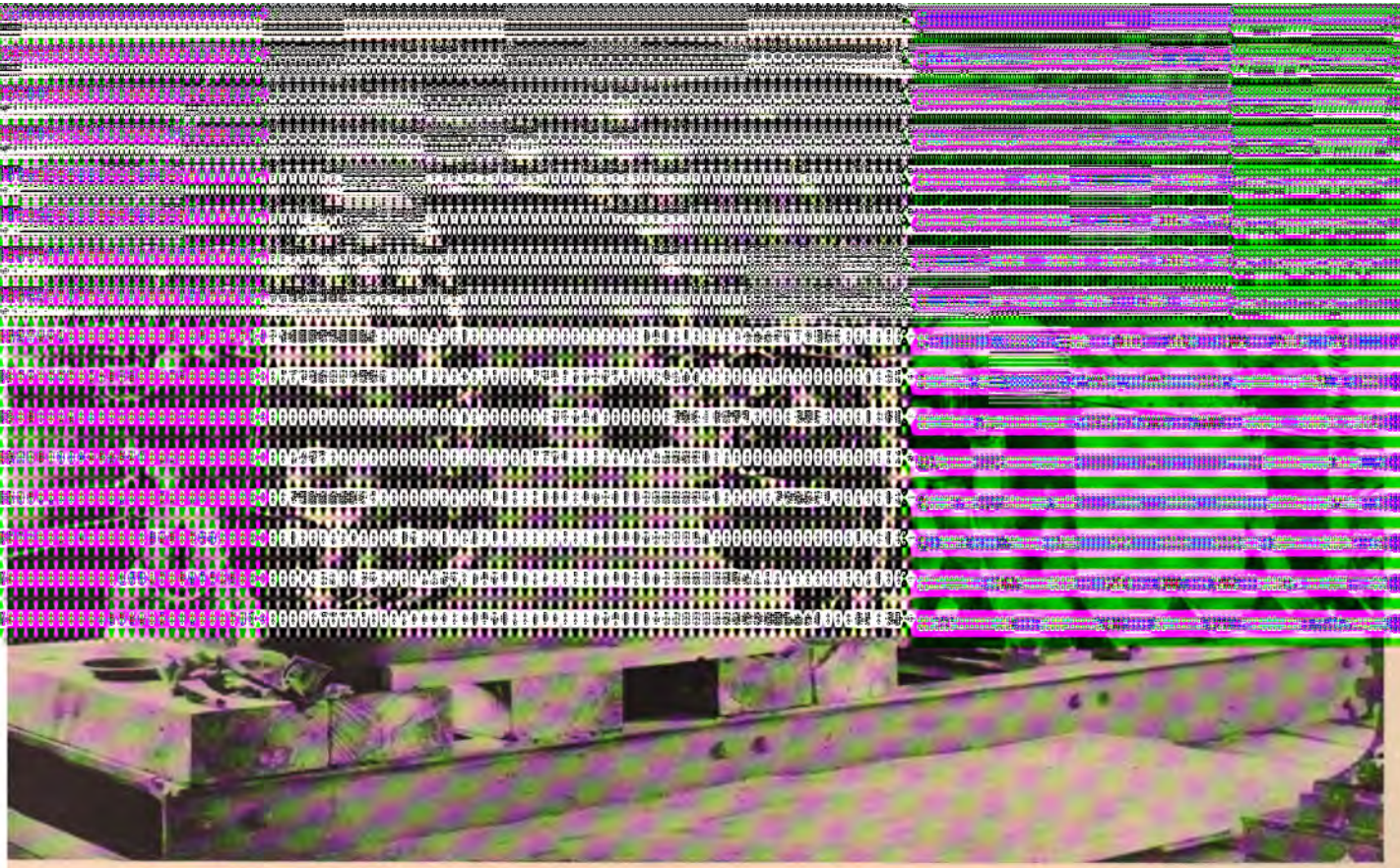
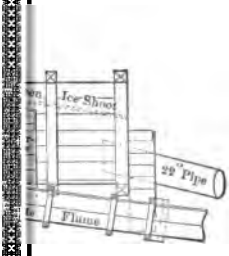
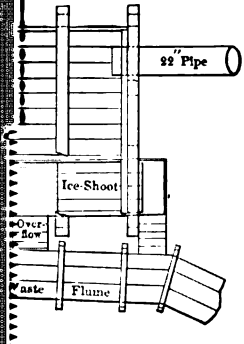


Plate I. Generator and Waterwheels in operation.





for power purposes when there was an

ard to the ditch and , pressure-tank, and pted, while it occa- to be recommended ng cold weather.

subsequent enlarge- d by friction. It is se in case of sudden traps of 1¼ in. round 20 ft., the remainder ints.

and 9½ ft. long, from sure of 152 lbs. per s, each wheel being er under the largest

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arrangement of the plant.
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erfly-valves placed in the
erging nozzles; and though
water to a greater or less

), it is a most satisfactory
is ample, and the loss due
overnor operates as follows:
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and the other by a No. 2

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g circular ratchets,
tudinally along the
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rod and levers that
is a hand-lever, by
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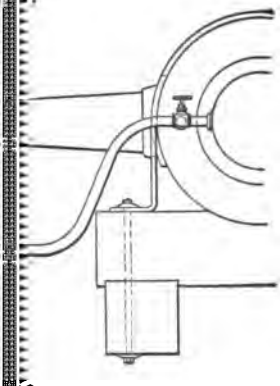

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by throwing out the
by the hand-lever.

After the wheels are at normal speed and the load is on, the ratchets are sprung into gear with the pinion, and the governor takes care of any and all variations, even to a complete throwing off of the load by pulling the main-current plug-switch at Bodie. The speed of the governor-pulleys, as first designed, was 60 revolutions. This was found to be too slow, and it was increased to 180 revolutions with most beneficial effects, developing a greater sensitiveness to small changes of load, and much quicker action, especially when all the load was thrown off at once. In the latter case, the increase in speed of the waterwheels did not at any time exceed 12 per cent before the governor began to close the valves.

It was further found necessary to furnish a constant resistance for the water motor that drives one side of the governor, to work against. In the original plan this was to be done by the exciter which furnishes current for the fields of the generator; but on trial it appeared that the load on the exciter was too variable, and at times too great for the little motor to take care of. The exciter was then placed so that it could be driven by either a larger size (No. 3) motor or by the waterwheel shaft-coupling (see plan of power-house); and a fly-wheel of about 1,500 lbs. weight was set to be driven by the smaller motor and insure its constant speed.

The great drawback to the use of water power for the generation of electricity has hitherto been the lack of a good water-governor, sufficiently sensitive and quick-acting to insure the vital factor of constant speed without bringing dangerous strain on the water pipe. In fact, in the Westinghouse plant at Telluride, and in several others of which the writer is aware, the "one-man automatic regulator" had to be used; *i. e.*, a man sat with his hand on the lever of a deflecting nozzle and his eye fixed on a voltmeter or a techometer. The above-described governor is so great an improvement over this system that its operation has been given in detail.

The generator is a Westinghouse 120 K.-W. constant-potential twelve-pole machine, and its armature-shaft is attached to that of the waterwheels by a rigid coupling, insulated by a disk of hard rubber one inch thick, and projecting one inch beyond the flanges, while the bolts are surrounded by bushings and washers of insulating-fiber.

The initial current in the lower half of each field-coil, or the winding nearest the armature, is instilled by means of a type "G" D. C. exciter. The secondary winding, on the armature-spokes of the dynamo, generates current when the machine is under load, which is led to a twelve-bar commutator on the armature-shaft and thence to the compensating-winding which occupies the upper half of each field-bobbin.

As the load on the generator increases, more current flows through its armature-coils, and through a primary winding on the armature-spokes, thereby inducing, in the secondary winding, a heavier current, which, being led to the magnetic field as described, proportionately strengthens the same. When the generator is running without load, there being little or no current in its armature-coils, none is induced in the secondary winding, and the compensating-winding on the fields is without magnetic effect until the latter is required by work to be performed.

The potential of the generator under full load is 3,530 volts, but at present it is operating with about 3,390. The exciter carries a voltage of 105 to 112. A "D. C." voltmeter, recently placed on the switch-board to the left of the ground-detector and above the small rheostat, is in the

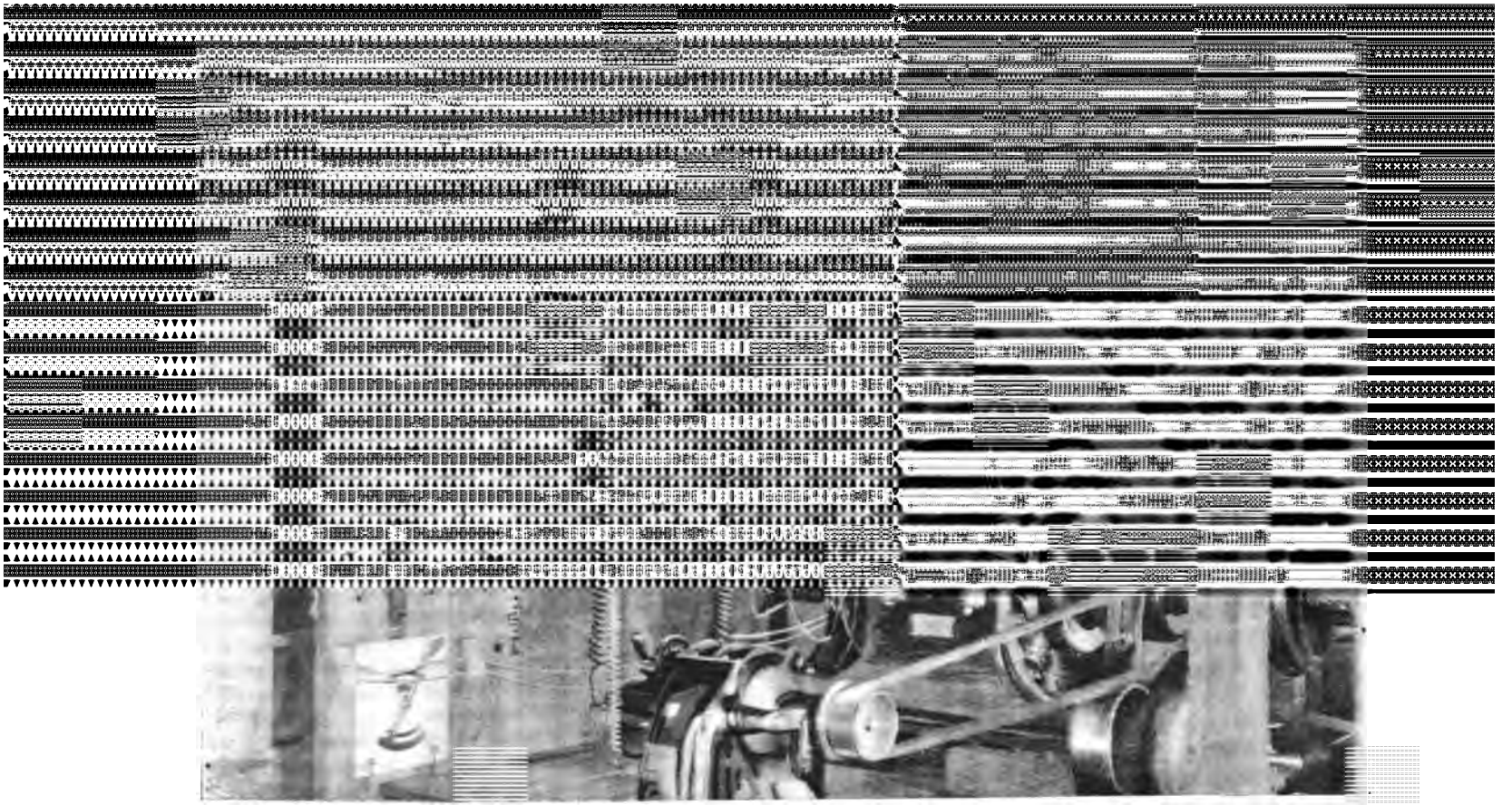


Plate II. Generator Switch-Board at Power-House. (Generator in operation; Exciter in foreground; Choke-Coils and Gap-Lightning-Arresters on separate board.)

main circuit of the exciter, recording the tension of its current and serving as a speed indicator when the machine is driven by the No. 3 motor. This is not necessary when driving from the wheel-shaft, as is sometimes done in winter, when pieces of ice give trouble in the small nozzle of the motor.

Plate II shows the generator switch-board at the power-house. The generator current is led from the collector-rings on the extreme end of the armature-shaft to the plug-sockets on the switch-board; and when the line-plugs are in these, the current follows the line to two similar sockets on the motor switch-board. The small converter in the upper middle of the switch-board has a transforming ratio of 30 to 1. Its primary coil is attached to the main-current wires from the generator, and its secondary to the A. C. voltmeter, immediately below it. A potential of 113 volts on the voltmeter is therefore equivalent to 3,390 on the dynamo current, which is the tension under normal load. The voltmeter does not, however, read 113 volts, but records 100 to 102 volts, the difference being due to the compensator (the instrument shown in the upper left-hand corner of the switch-board and connected with the voltmeter), the object being to reduce the reading by an amount about equal to the line-loss. This loss is estimated at 15 per cent under maximum load, and is but from 8 to 10 per cent under normal load, as will be shown later on.

The ammeter, and just below it the aluminum fuses, all of which are in the main circuit, are shown to the left of the voltmeter in the view of the generator switch-board.

Immediately to the left of the main-line plug-switches is the ground-detector with two lamps, one for each leg of the line, and each lamp with its converter behind it.

A press-button below the lamps makes the necessary connection with a ground wire. Without this connection made, the lamps show a red light on the filaments, due to the difference in potential of the two sides of the line; and should a "ground" occur on either leg of the wire-line, the corresponding lamp immediately burns at full candle power, while the other lamp proportionately diminishes.

The two-pole jaw-switch to the left of the switch-board is in the circuit from the exciter to the generator-fields, as are also the two fuses and the rheostat immediately below it. The small rheostat to the right of the fuse-blocks and the single-pole switch below it are in the shunt field-circuit of the exciter. By means of these two rheostats the potential of the generator is governed and the voltmeter kept at its proper reading, the large rheostat in the exciter and generator field-circuit permitting a quick regulation over a wide range, and the shunt-rheostat a finer and closer adjustment of the voltage.

When starting up the plant one attendant stands at the lever, controlling the admission of water to the wheels through the butterfly-valves, and the other at the switch-board, handling these two rheostats (most of the regulation is done by the large one), until the motor is in synchronism and at work, when the governor is thrown into gear, the voltage is finally adjusted, and the mechanism is then practically self-regulating for all ordinary changes of load. If, for instance, ten of the twenty stamps are to be hung up, or any or all of the eight continuous-pans in the mill are to be stopped, it is never necessary first to give word to the attendant at the power-house. The governor takes charge of such

changes, even to the entire throwing off of the load, as before remarked. All the bearings of the generator and waterwheel shafts and of the exciter are self-oiling. The attendant has merely to keep on the *qui vive* and see that all is running smoothly. Any change in tone of the hum of the dynamo warns him at once of a change of conditions, the tone rising or falling according as the speed increases or diminishes, though ever so slightly.

To insure the all-important factor of constant speed, a tachometer, registering to 1,200 revolutions, is belted to the waterwheel and dynamo shaft. Its dial faces the waterwheels, so that the attendant at the valve lever can readily maintain a uniform speed during the operation of "synchronizing" the motor and starting the mill, at which time the load is constantly varying.

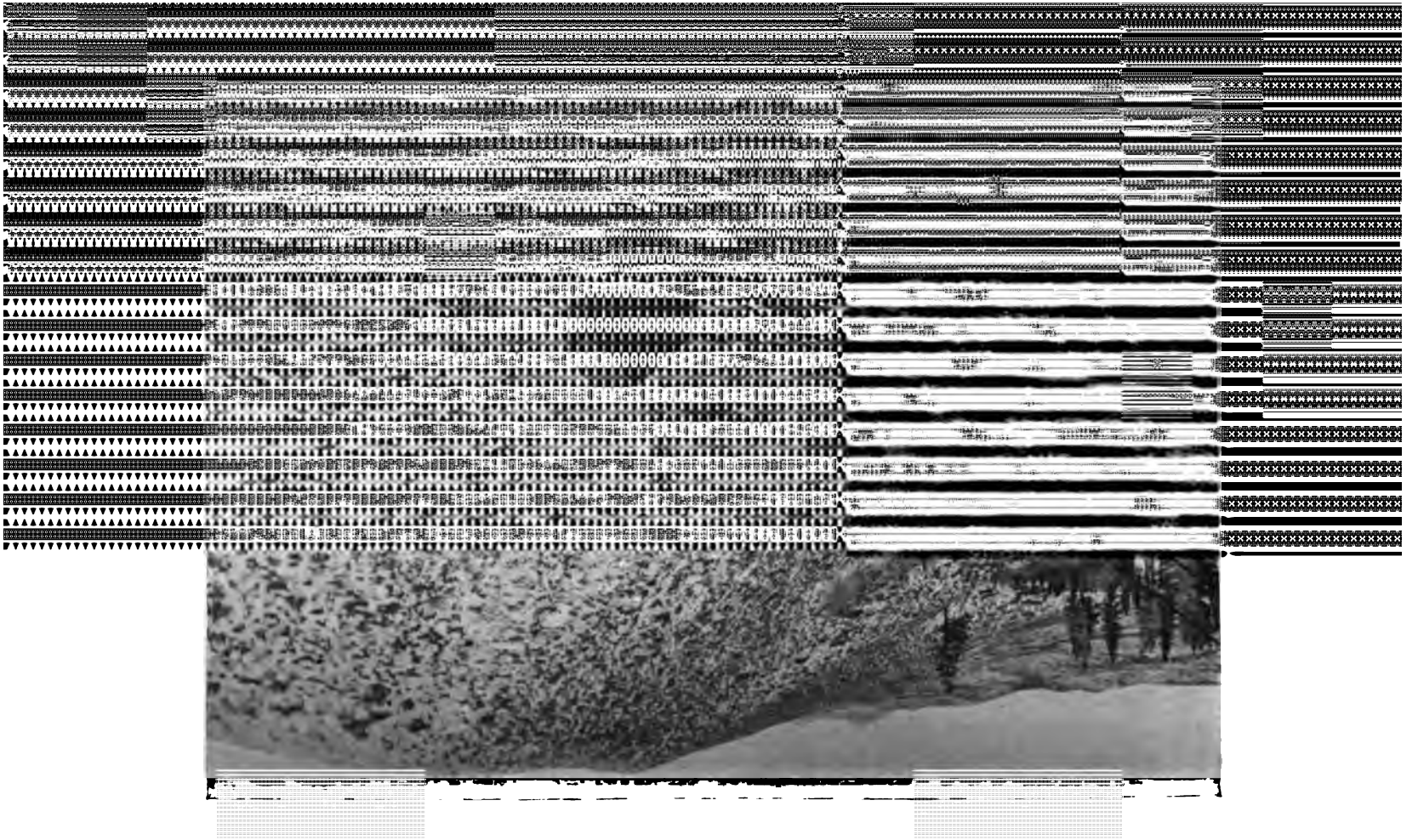
In front of the jaw-switch on the switch-board there will be noticed, in the view of the latter, a steel spring, and also two cords attached to the handle of the large rheostat. These cords are led around the side of the building to the attendant's place at the valve-lever, as is also the one that releases the catch of the spring. A pull on these cords opens the exciter main-circuit instantly, and puts in the entire resistance-box, thereby "killing" the fields of the generator and preventing any dangerous rise in electro-motive force, should the load be suddenly thrown off by a break in the wire-line, or other accident causing a sudden increase in the speed of the armature shaft. It should be explained that this arrangement was devised by the writer, before the speed of the governor was trebled, the constant-resistance fly-wheel was put in and other changes were made, giving more sensitive and perfect control of the water power; and it is left in place because it might still be of use in case of emergency. The power-house is lit by a small 10-light converter attached to the generator-circuit, and when the generator is not in operation, by current from the exciter. Plate III shows the power-house at Green Creek.

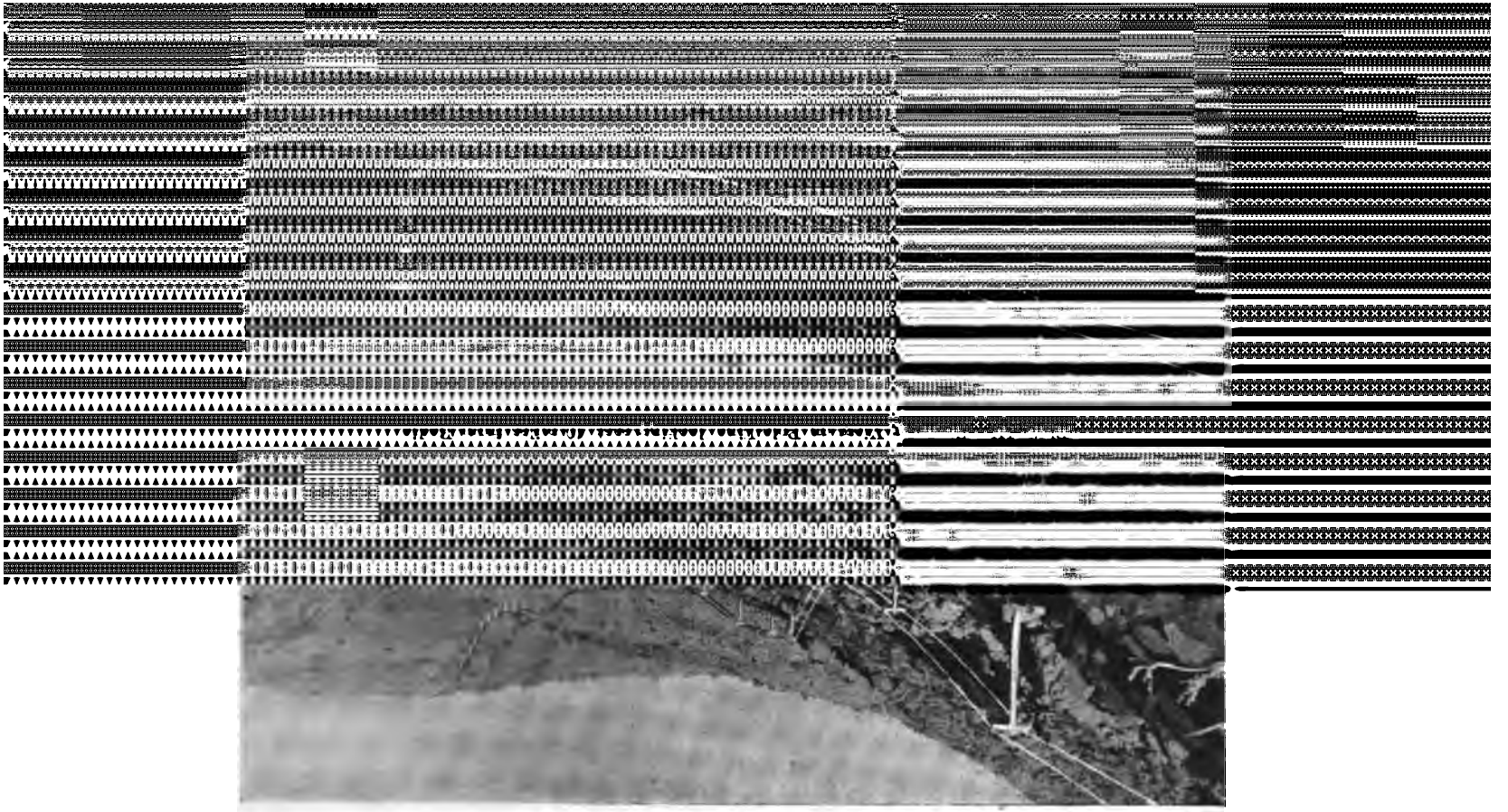
Wire-Line.

The length of the line is 67,760 ft., or 12.46 miles. The poles are of round tamarack timber, 21 ft. long, 6 in. in diameter at the top, set 4 ft. in the ground; poles 25 ft. long being used through the town, and along the line wherever there is danger of deep snowdrifts. They are placed 100 ft. apart, and fitted each with a 4 by 6 in. cross-arm, boxed into the pole, and held by one bolt and one lag-screw. The accompanying sketch (Fig. 8) shows the detail. The object of chamfering the ends of the cross-arms is to leave less room for the lodging of snow under the insulator.

The line crosses extremely rough country, not 500 yds. of which is level beyond the town limits. Most of the ground is very rocky, over 500 lbs. of dynamite being used in blasting the pole-holes. Plates IV and V are views along the line in summer.

The wire is of No. 1 (B. & S.) gauge, soft-drawn bare copper, and is attached to standard, double-petticoat, deep-groove glass insulators (Fig. 10) carried on Klein patent iron pins (Fig. 9). The distance between the wires is 3 ft. 8 in., and there are over 16.5 tons of copper in the line. The only objection found to the iron pins is their liability to be withdrawn from the cross-arm during a gale of wind, whenever there is an upward pull on the wire. To obviate this a number of pins were drilled





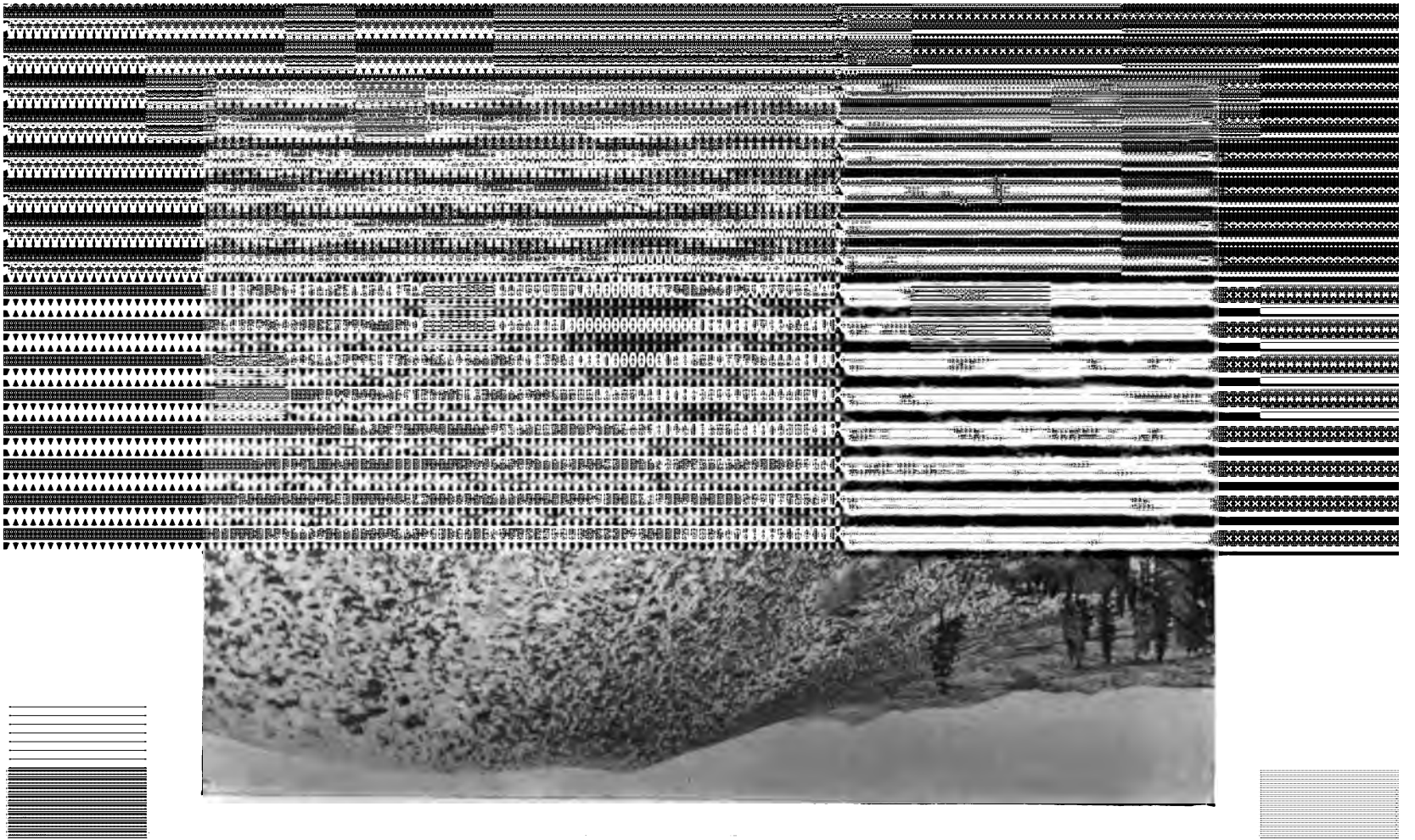


Fig. 8.

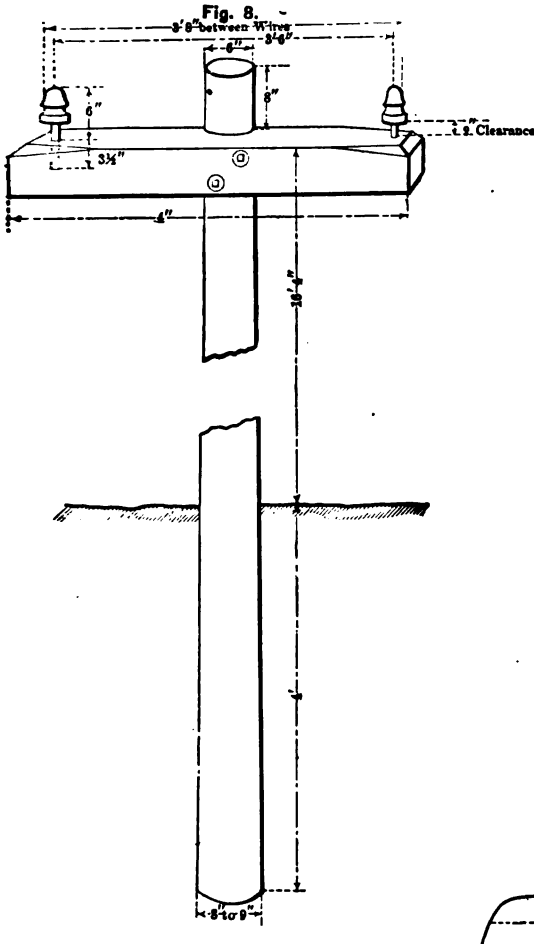
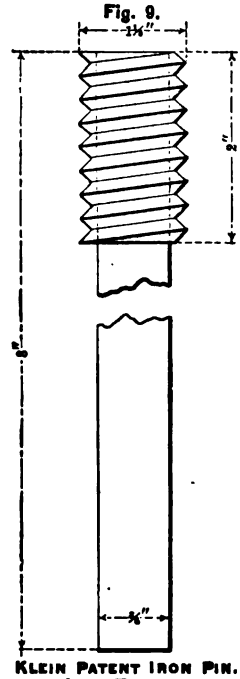
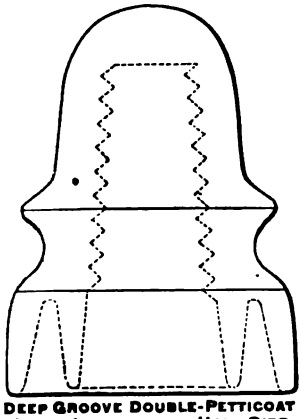


Fig. 9.



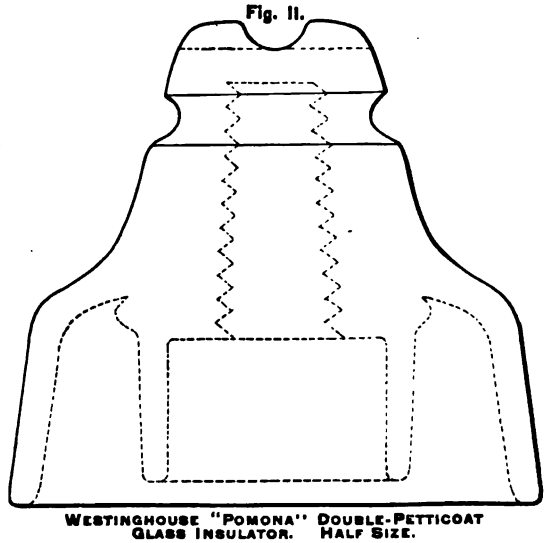
KLEIN PATENT IRON PIN.
LEAD THREAD.

Fig. 10.



DEEP GROOVE DOUBLE-PETTICOAT GLASS INSULATOR. HALF SIZE.

Fig. 11.



WESTINGHOUSE "POMONA" DOUBLE-PETTICOAT GLASS INSULATOR. HALF SIZE.

LINE DETAILS.

ch places these were used, them.

ors by tie-wires of No. 10 isable to insulate the line- rdinary sheet-rubber $\frac{1}{8}$ in. o strips 1.5 in. wide and ut the wire and held in oe. The whole was then lated wire re-attached to oof copper wire.

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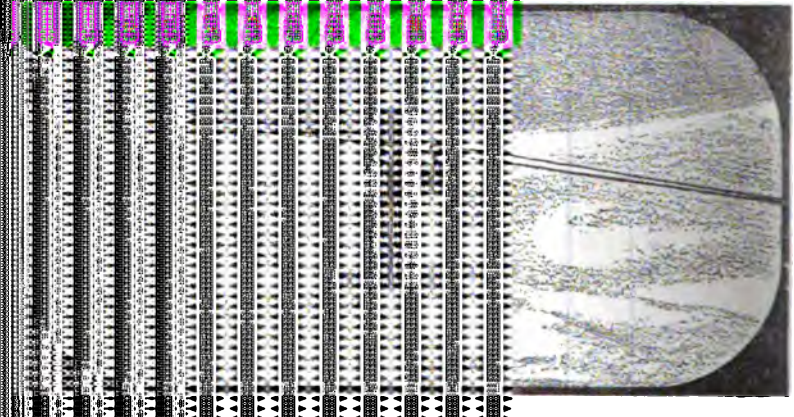
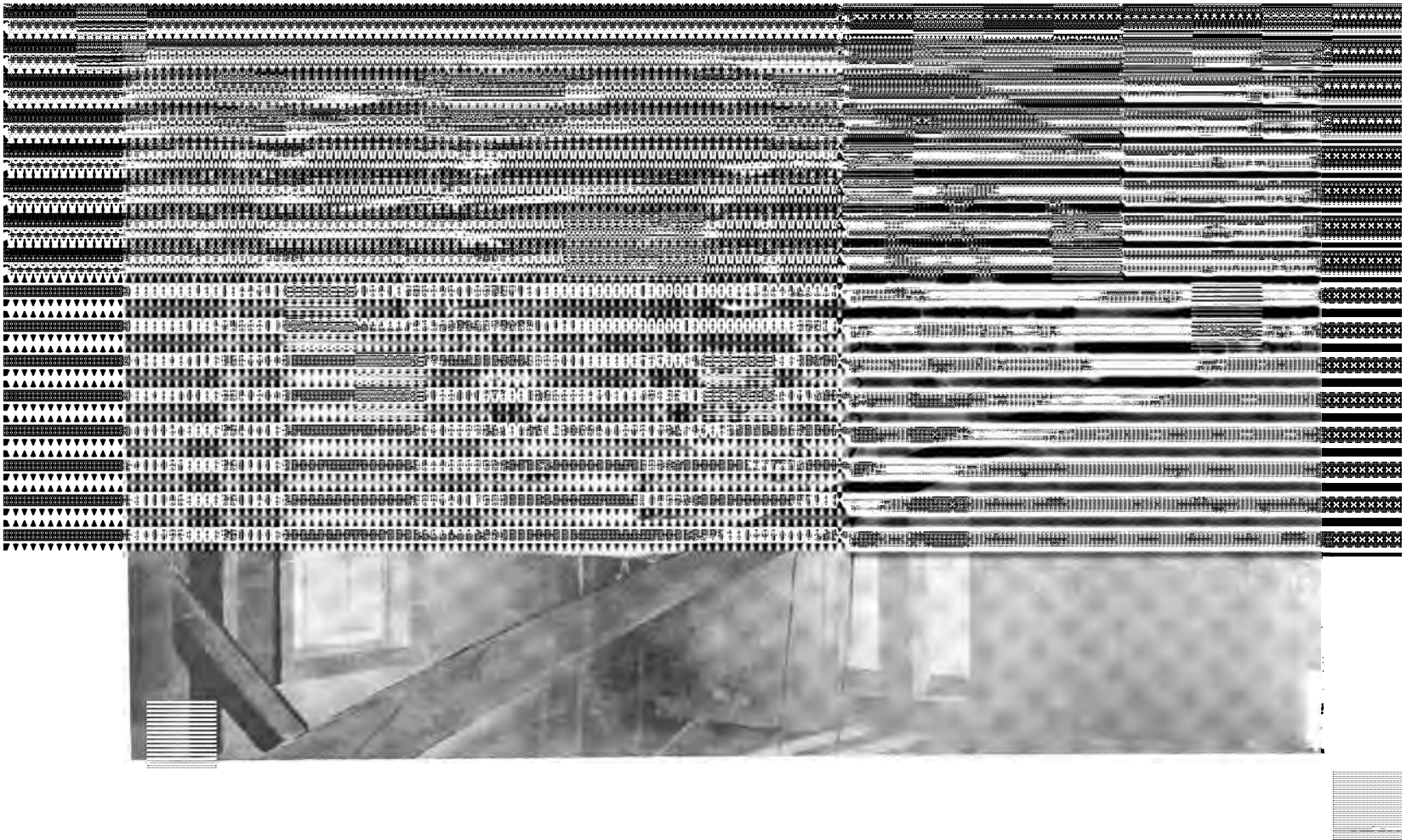
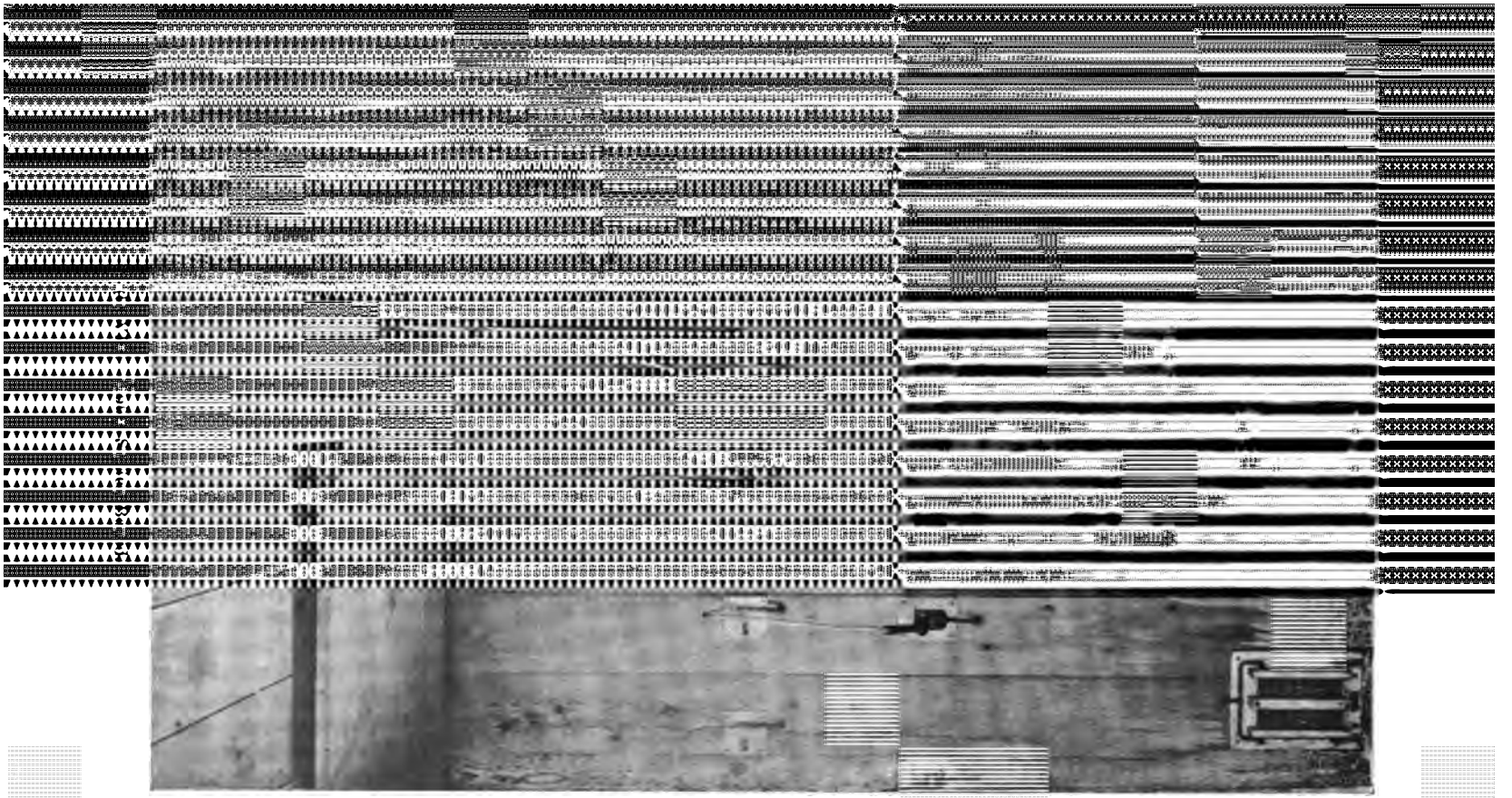


Mill.
15 ft. deep, March, 1893.)

and has carried the high uring a severe storm of ten d ice toward the end; but d after the wire had been act, one of the chief objects f against just such a storm r. (See Fig. 12.)

he Standard Consolidated hronous constant-potential ins twenty 750 lb. stamps, ontinuous-process amalga- inding), three settlers, one





agitator, one pan and settler devoted to the amalgamation of concentrates, a bucket elevator, a worm-gear hoist, and a rock-crusher. In order to determine accurately the capacity of motor required, a number of cards were taken with the Tabor indicator from the 20 by 36 inch steam engine that drove the mill, showing an average of 90 and a maximum of 101½ horse-power.

The fields of the motor are self-exciting through a secondary winding on the teeth of the armature, the current being led to a twelve-bar commutator similar to that on the generator. In fact, the motor is almost identical with the generator, the chief difference being in the compensating-winding on the field-bobbins of the latter.

On the armature-shaft of the motor is a friction-wheel, and beyond this a clutch, which is used to set in motion the driving-pulley and the machinery of the mill. On the same bed-plate with the motor is a small 10 horse-power Tesla starting-motor, with a wooden pulley on its shaft, that is brought to bear against the friction-wheel mentioned, by means of a screw and hand-wheel. This Tesla motor consists simply of field-coils and an armature; it has neither brushes, nor commutator, nor sliding contacts of any kind. The alternating current is led directly into the fields, the stationary element, the coils of which, being connected in series, produce a rotating magnetic field, in that each pole is alternately positive and negative. The starting-torque of the armature is, in consequence, very low, and it has to receive several rapid turns by hand before putting on the current, after which it generally runs up to normal speed (1,660 revolutions) within a minute. Plate VI shows the motor in operation.

Turning our attention to the switch-board, shown in Plate VII, the two plugs in the sockets on the right of the board are the line-plugs, and the two to the left of them, in their rests, are the starting-motor plugs. When the line-plugs are in their sockets the current is led directly to the top of the upper jaw-switch, and this switch is never closed until the machines are in synchronism. The wires from the bottom of this switch lead directly to the collector-rings on the armature-shaft of the motor.

In the upper right-hand of the board is the Wurts lightning-arrester, consisting of 22 spools, 11 on a side, separated each by a distance of $\frac{1}{32}$ in. Both legs of the wire-line are attached to the arrester, one on each side at the top, while the ground-wire leads from the bottom spools to a water-pipe in the earth. The spools are made of a patent non-arcing metal, and the dynamo current will therefore not follow the path through them made by a discharge of high-tension atmospheric electricity. The properties of this alloy are such that oxides of the metals are generated by the passage of lightning and not vapor of the metal itself.

To the left of this instrument are two converters of the ratio of 30 to 1, filled with paraffine oil. The primary coil of the right-hand one is connected to the main line just above the plug-sockets, and that of the left-hand converter is connected to the motor-circuit, *i. e.*, the wires leading from the collector-rings on the armature-shaft to the bottom of the upper jaw-switch; it being understood that the motor acts as a generator when being driven by the starting-motor.

The secondary of the line-current converter goes to the top posts, marked G, of the synchronizer (the marble plate with four lamps on it to the extreme left of the board), one leg being first carried through the

right-hand side of the lower jaw-switch. When the line-plugs are in, therefore, and this switch is closed, the top light of the synchronizer will always be burning while the generator at the power-house is in operation.

The secondary of the motor-current converter is carried directly to the bottom posts, marked M, of the synchronizer, the two middle lamps of which are connected in series with the motor and generator currents.

The field-circuit of the motor is carried to the switch-board, and in it are placed the large rheostat, the left-hand ammeter, and the left-hand side of the lower jaw-switch. The closing of this switch and an adjustment of the rheostat will therefore cause the lower light on the synchronizer to burn whenever the motor is being run as a generator, as is the case when it is being driven by the starting-motor. The aluminum fuses showing below the converters are in the main line before it reaches the jaw-switch, as is also the ammeter just below them, which instrument should, and does, record the same volume of current as its fellow in the power-house.

To start the motor requires two men, one to handle the starting-motor and the other at the switch-board. The line-plugs are put in, which leads the main current to the top of the synchronizing-switch, and the lower jaw-switch is thrown in, which closes the field-circuit of the motor, and the secondary of the main-line or generator converter, thereby lighting the upper lamp of the synchronizer. The armature of the starting-motor is turned a few times by hand, and the two left-hand plugs are then pushed into their sockets, leading the current from the main line to the fields of this motor.

Immediately upon doing this, the main-current ammeter records 30 amperes, and the needle stays at this reading until the starting-motor is up to speed, when it drops quickly to 18 to 20 amperes. It takes from fifty to seventy seconds for the starting-motor to reach full speed, after which its friction-wheel is brought to bear against that of the main motor, and the armature of the latter begins to revolve. During this time the synchronizing-switch (the upper jaw-switch) is open, and all the resistance-coils of the rheostat are left in the field-circuit, in order that the armature may more easily be brought up to speed, by preventing the flow of current in the same.

As soon as the armature is above speed, about two thirds of the rheostat is thrown out, permitting 40 or 50 amperes of current to flow, and the lower lamp of the synchronizer to burn. The pushing onto its button of the little switch on the bottom of the synchronizer now connects the two central lamps in series with the motor- and the generator-currents, and they begin to flash in accordance with the phases, and therefore the speeds, of the two machines. As the speed of the motor approaches that of the generator, the wave-phases come nearer coincidence, and these lamps brighten and darken almost simultaneously.

The attendant stands with one hand on the rheostat and the other on the open jaw-switch, watching these waves of light intently, and just as the two lamps darken in unison, he throws in the switch and pulls one of the starting-motor plugs. The lamps only remain "out" for a second or less, while the speeds are together, and then flash up brightly again as the motor speed drops off; there is therefore but a fraction of a second during which the jaw-switch should be closed, though this time can be lengthened slightly by a proper handling of the starting-motor.

If this switch has been thrown in at the right moment, the series lights remain "out," while the top and bottom, or "pilot" lights, burn brightly, and so continue all the while the machines are in operation.

If the switch is thrown in a second or so too soon, the main-current ammeter will fly up to 40 or 45 amperes, and quickly drop down to less than 10 as the motor speed decreases, and it falls into step with the generator, while the series-lamps will remain dark, and the pilot-lamps burn as usual. On the other hand, if it is closed several seconds too soon, or a fraction of a second too late, it is impossible for the machines to get into synchronism. In such event all the lights on the synchronizer go out at once, and a heavy flow of current sets in, the main ammeter showing 45 amperes, which is as high as it can record. By the extinction of the lights the attendant sees at once that he has missed the synchronizing-point, and immediately pulls the main-line plug, opens the jaw-switch, and starts over again. The second trial, however, will not consume as much time as the first, since the starting-motor is still revolving at a high speed, and more quickly comes up to its normal rate, while the motor-armature is also running yet at several hundred revolutions per minute.

This very rarely happens, especially since the addition in March last of an acoustic synchronizer to the phase-lamp device. This instrument emits a sound, the pulsations of which are very rapid at first, the interval between them growing longer as the machines approach equal speed, and settling into a steady hum at the moment of synchronism.

It will be noticed that in order to break the circuit and stop the motor it is necessary to pull the line-plug, on doing which a brilliant arc, sometimes 2 ft. in length, if 25 amperes are flowing, follows out from the socket to the plug-tip. Any attempt to open the jaw-switch while the line-plugs are in would doubtless result in the death of whomsoever tried it, since the distance is too short in which to break the arc, and the current would likely follow down the arm in spite of one's standing on an insulated floor. These floors are used around both generator and motor, and in front of both switch-boards.

The entire operation of starting up the motor from a state of rest occupies from three to five minutes, and when once in synchronism, the clutch can be thrown in and the mill shafting brought to normal speed in from one to two minutes more, after which the load may be thrown on as fast as desired without the least danger of pulling the motor out of synchronism. The clutch is always thrown in slowly in order to prevent too heavy a flow of current, and consequent sparking of the commutator brushes.

By means of a single counter-shaft, fitted with self-oiling boxes, the high speed of the motor (860 revolutions) is reduced to the necessary 80 revolutions of the battery line-shaft, the reductions being 2 ft. to 8 ft., and 3 ft. to 8 ft. Light steel-rim balanced pulleys are used, and an endless 16 in. double leather belt runs from the motor to the first 8 ft. pulley. The speed of this belt is 5,400 ft. per minute, and it is kept tight by levers which, acting through screws, move the entire motor and its bed-plate along four grooved, cast-iron slides.

The motor is separated from the underlying brick foundation by means of 8 by 10 in. timbers, which are bolted to the latter and covered by three layers of 1 in. boards; and to this wood insulation the slides referred to are fastened by lag-screws that pass through the boards into

the timbers. The generator is insulated from the I-beams that carry both it and the waterwheels, by timbers 5½ in. thick, to which it is likewise secured by lag-screws.

The mill and offices of the company are lit by 100-volt incandescent lamps, taking current from a large 100-light converter, ratio 30 to 1, which is attached to the main line in the motor-room, before it reaches the switch-board. The light is very satisfactory, even to read or write by, although at times the lamps flicker slightly, due to small changes of load. This variation of intensity is, of course, unavoidable where the lighting current is taken direct from a power circuit; but, in the present case at least, is not sufficiently noticeable to cause inconvenience.

During normal operation of the plant, the field-ammeter of the motor is, by means of the rheostat, kept steadily at 52 amperes, while with full load on the mill the main-current ammeter registers from 23 to 25 amperes. The needle oscillates over a range of 4 to 6 amperes, showing considerable variation of load, due undoubtedly to slipping of the belts, unequal resistance of the grinding-pans, rock-crusher, etc., so that it is difficult to read this ammeter closely, either at the generator or at the motor.

The average amperes of current can be very closely approximated, however, as was done in the tabulated readings given below, which were taken with the object of determining the line-loss, and with the aid of Mr. H. M. Reed, the engineer of the Westinghouse Electric and Manufacturing Company, who installed and first operated this apparatus.

The readings were taken simultaneously at power-house and motor-room, by means of the telephone, and the figures given are the averages of five or six consecutive observations. There being no voltmeter on the motor switch-board, a Weston portable voltmeter was used, the wires being attached to the lower posts on the synchronizer.

The table is merely a rough approximation of the efficiency of the transmission, there being no instruments at hand for close work, such as the measurement of the wheel-shaft energy, or of that given out at the motor-pulley. The efficiency of these machines, namely, of the generator, 95.5 per cent, and of the motor, 93.9 per cent, was determined by Mr. Fred. A. Davis, electrical engineer of the Westinghouse Electric and Manufacturing Company, in charge of the plant. It will be noticed from the table that the line-loss is very light, and also that as the dynamo and motor approach their rated capacity, the efficiency of the transmission increases.

Approximate Efficiency of the Transmission at the Standard Consolidated Mine, Bodie, California.

Date.	Generator. Volts. Voltmeter Reading.	Generator. Volts. Equivalent to Volts.	Generator. Amperes.	Mechanical Horse-Power Given Out by Generator.	Horse-Power Given Out by Water-Wheels, allowing 95¼ per cent Efficiency for Generator, and adding 5 Horse-Power for Exciter.	Motor. Volts. Voltmeter Reading.	Motor. Volts. Equivalent to Volts.	Motor. Amperes.	Mechanical Horse-Power Delivered to Motor.	Line-Loss—Per cent.	Mechanical Horse-Power Given Out by Motor, allowing 93.9 per cent Efficiency.	Approximate Per Cent of Full Mill-Load Driven at Time of Test.	Approximate Per Cent of Water-Power Obtained at Motor-Pulley.
December 22d	100	3,390	20	90.9	100.2	103	3,090	20	82.8	8.9	77.7	82	77.2
December 29th	100	3,390	21	95.4	105.0	103½	3,100	21	87.3	8.6	82.0	85	78.2
January 16th	100	3,390	23	104.5	114.4	104	3,120	23	96.2	8.0	90.3	95	79.0
February 1st	101	3,420	25	114.6	125.0	105	3,150	25	105.5	8.0	99.0	105	79.2

NOTE.—During the above test the exciter was being driven from the wheel-shaft instead of by its separate water motor; hence, the allowance of 5 horse-power.

The proper setting of the brushes on the commutator of the motor-armature is a knack acquired only by experience; and for awhile considerable trouble was caused by undue sparking at these brushes. Experience on the part of the attendants has entirely overcome this; but it has been found necessary to use two commutators, keeping one always turned and polished ready for use, and changing them usually after twenty-five to thirty days of steady operation.

In order to stop the motor, the load is thrown off by means of the clutch, and the line-plug is then pulled. Should the plug be pulled without first throwing off the load, a momentary rise in electro-motive force may follow, sufficient to damage an armature-coil. This has happened once in our experience, and the very high potential was vividly shown by the discharge through the lightning-arresters at both ends of the line.

The dependence of the motor speed upon the alternations of the generator is very prettily shown, when, without pulling the line-plugs, the machines are stopped by shutting off the water on the wheels. The motor then slows down in exact accordance with the generator, and is at rest within half a minute or so; whereas, when the plug is pulled in the usual way, the motor-armature will revolve for several minutes from its own momentum before coming to a stop.

This plant has accomplished several unbroken runs, day and night, one of thirteen days' and another of twenty days' duration, but latterly it has been operated more intermittently, on account of the mill being run upon only half-time. During December, 1893, the plant was started twenty-three times in twenty-one days, and in January eleven times in as many days (in accordance with the requirements of the milling work), these daily startings being an excellent test on both the starting-motor and machines, as at such times the differences in potential, and consequently the strain on the insulation, are likely to be a maximum.

The only trouble now experienced with the plant comes from an extraneous source, common, in a greater or less degree, to all electrical plants throughout the world, namely, occasional incursions of lightning during thunder-storms; or from another, more local cause, already alluded to, namely, discharges of static electricity, due to a gradual charging of the line from a highly charged atmosphere during wind-storms. These have several times caused the burning-out of armature-coils; but this matter is not as serious as it may seem, since but a couple of hours are required to repair such damage. To put in a new coil, the top-half of the field of the machine, weighing about two tons, is swung off by means of differential blocks and an overhead trolley; the burnt coil is cut out with a hack-saw; the new coil is slipped over the tooth and squeezed into place by means of specially-made geared clamps; the connections are soldered, taped, and painted; and the top-field is then replaced in position.

The entire cost of this plant does not exceed $38,000, while its operation during the month of October alone effected a saving of $2,100, equivalent to $1 46 per ton of ore crushed, and reducing the total milling cost to $2 32 per ton; a fairly low figure for a high-priced camp (wages $4 per day) such as Bodie.

At present the plant is operating most smoothly, and is successfully demonstrating the effectiveness and simplicity of the single-phase syn-

chronous system for such work and distances, while the daily saving over the use of steam, on twelve-hour runs, is from $35 to $40.

The writer takes pleasure in acknowledging the aid of his assistant, Mr. R. C. Turner, E.M., in the preparation of the accompanying drawings.

EXTENSION OF THE SYSTEM.

The availability of electric power; the readiness with which, after it is once introduced, it can be applied to any extensions of surface plant or new works such as continually arise in progressive mining, has been recently demonstrated in our experience at Bodie.

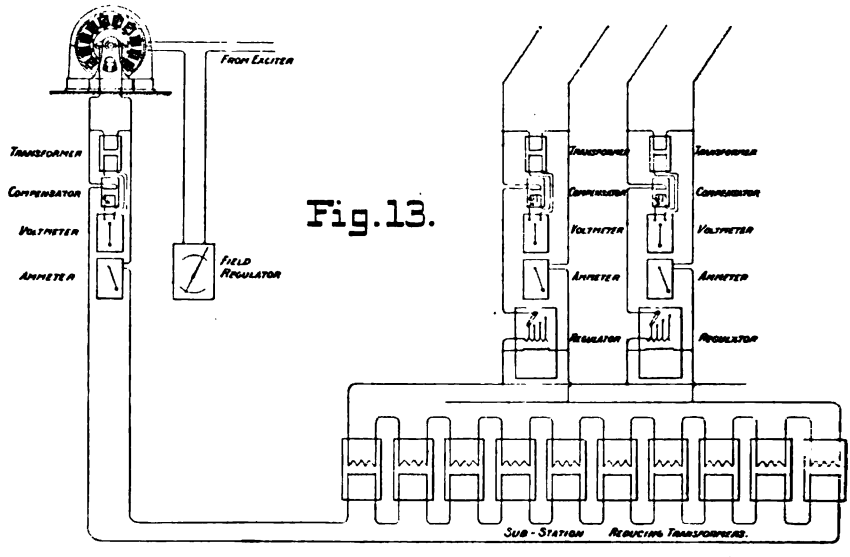
For the rapid handling of the tailings, which were to be treated in large vats by a leaching process, it became necessary to put up an incline track about 1,400 ft. away from the mill. To haul the cars up this grade by electric power all that was required was to put in a 15 horse-power direct-current generator at the mill, belt it to the motor, and take current at 500 volts to a 10 horse-power motor at the top of the incline. This is being done, the balance of 5 horse-power to be used in lighting the leaching-plant and operating the necessary pumps.

With electricity this transmission of power to the new plant was extremely simple. By rope or other means it would have been expensive, costly to maintain, and much less efficient.

The following description of the transmission plants of the San Miguel Consolidated Gold Mining Company, of Telluride, Colo., and of the Willamette Falls Electric Company of Portland, Oregon, is taken from "Long-Distance Transmission for Lighting and Power," by Charles F. Scott, being a paper read at the general meeting of the American Institute of Electrical Engineers, Chicago, Ill., June 7, 1892:

"The test of practical operation in long-distance transmission has been applied in but few cases, and the severe test of continued operation over a considerable length of time is of rare occurrence. The latter is the crucial test, and its commercial significance gives it the highest importance. The continued and successful operation of one plant for a year, under extreme conditions of situation and service, is of higher value in testimony to the practical development and possibilities of electrical work than many elaborate projects, or the operation of novel apparatus for a short time.

"It is with this idea in mind that a description is here to be given of two plants, one for lighting and the other for transmission of power. The conditions which have been met include a very considerable distance, extreme difficulties of climate and roughness of country, exacting requirements in continuity of service, and a pressure above that ordinarily used in the class of machines employed. The plants to be described are the first of their type installed in this country, and the apparatus in the power-plant is of a kind that has not been heretofore used. The type and construction of the machines, and the arrangement of apparatus, are new in many particulars, and as they have contributed largely to successful operation they will be described with some minuteness. Alternating-current machinery is employed, constructed by the West-



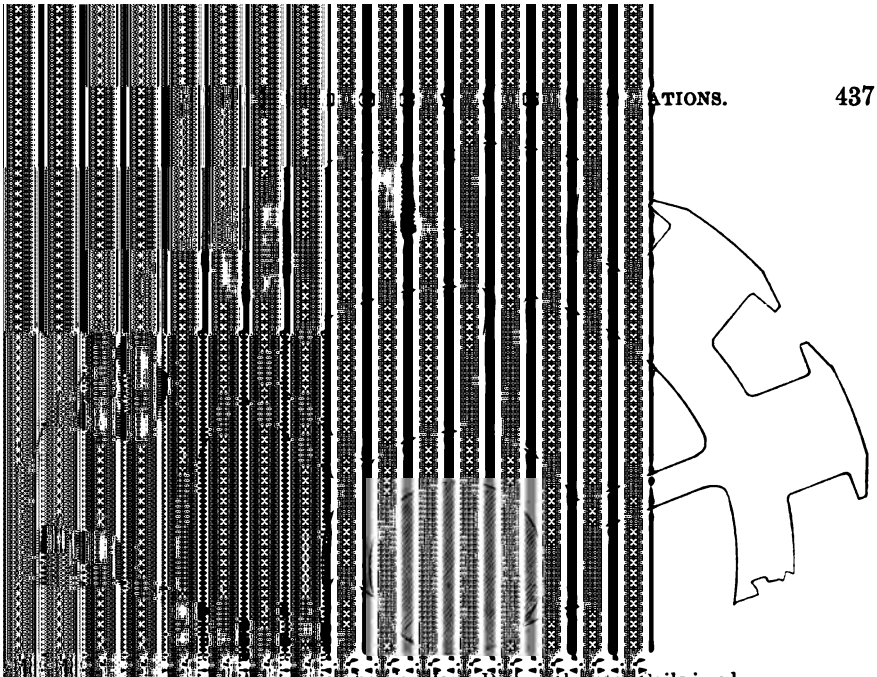
Lighting-Plant at Portland. Diagram of Apparatus and Connections.

inghouse Electric and Manufacturing Company, the pioneer company in alternating work in this country.

"The lighting-plant was first installed. It is operated by the Willamette Falls Electric Company, of Portland, Oregon. The general requirements are those which electrical transmission is admirably adapted to meet. The falls of the Willamette River, at Oregon City, in the combined points of size, accessibility, and nearness to the seaport, are unequaled. These falls, estimated at from 200,000 to 250,000 horse-power, are about 13 miles from Portland, and it requires but a moment's thought to appreciate the value of an agent which can make this power available in the city.

"The Willamette River is about one quarter of a mile wide, and the fall is about 40 ft. The present station is located on an island at the middle of the river. Victor wheels of 300 horse-power are geared to horizontal shafts, from which the dynamo belts pass to an upper floor at an angle of 45°. Two alternating-current dynamos for incandescent lighting are driven by each wheel. The current, at a pressure of 4,000 volts, passes directly to the line of No. 4 B. & S. wire, which is carried on ordinary double-petticoat glass insulators across the level country to a sub-station in Portland. The current is received at 3,300 volts by transformers in the sub-station and is reduced to 1,100 volts, for distribution by various circuits through the city to ordinary transformers, by which it is reduced to 50 or 100 volts.

"When the apparatus was designed it was not considered practicable to generate 4,000 volts with the ordinary type of machine, in which the wire is wound upon the surface of the armature on account of the difficulty of insulating for more than 1,000 or 2,000 volts. The work was undertaken with a new type of armature, which is specially noteworthy, as it has rendered high potentials practicable in a machine of simple construction.



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on that transformer disappears, and the others are called upon to do a larger share of the total work without interfering with service. The efficiency of the transformer at full load is 96 per cent.

"The plant was first installed with two incandescent machines, and started nearly two years ago. Since that time five additional machines have been added, so that there are now seven, each with a capacity for supplying 1,250 16-candle-power lights, in Portland. The total capacity is 8,750 lights. The dynamos run admirably. There was one night when several armature-coils were burned out, which was attributed to an iron wire falling across the main line and connecting several of the circuits, grounding them. Otherwise there have been no difficulties to speak of with regard to the operation of the machines. The Superintendent of the plant states that the line has given very little trouble, much less than would ordinarily be expected from a city line. He also says that 'the converters in the sub-station have not given one minute of trouble, and have not cost one cent for repairs.' One explanation of the success of the plant is the intelligent policy of the General Manager, in harmony with his statement that 'It is not the first cost which counts, but the cost of throwing out and replacing apparatus.'

"The same policy has happily governed the installation of the second plant to be described—the power-plant. This is located near Telluride, Colo., and is owned by Mr. L. L. Nunn. The Gold King mill requires power for operating its crushers and stamps, and fuel can come only from long distances at enormous costs. A few miles from the mill there is a water-power, but the country between the two points is steep and rough, and for many months in the year is covered with snow. Electricity is the one means of getting the power from its source to the mill. The conditions are of the most favorable character for demonstrating the value and possibility of electrical transmission.

"In this plant a Pelton wheel, receiving water through a 2 ft. steel pipe, under a head of 320 ft., drives an alternating-current generator. The current is carried over a line of bare wire to the mill, which is nearly 3 miles distant, and drives an alternating-current synchronous motor of 100 horse-power. The generator and motor are machines of the same size and form of construction as the dynamos at Portland, already described, and differ from these only in some minor modifications.

"The generator is provided with a composite field winding. A part of the magnets are excited by direct current from a separate machine, and the rest are excited by a current from the generator armature, which is proportional to the main current, and is commutated by the equivalent of a two-part commutator. The adjustment is such that the E. M. F. on the main terminals rises as the current delivered by the machine increases, compensating for line-losses and keeping the pressure at the motor 3,000 volts. The speed is 833 revolutions, giving 10,000 alternations per minute. The switch-board and regulating appliances are similar to those in the station at Portland. Ordinarily no adjustment is required after the machine is started, and the attendant has little to do besides looking after the mechanical running of the apparatus.

"When the motor is running, the only things to be cared for are the brushes and the bearings. The high-tension brushes—the only point besides the switches where the high tension is exposed—will run for a

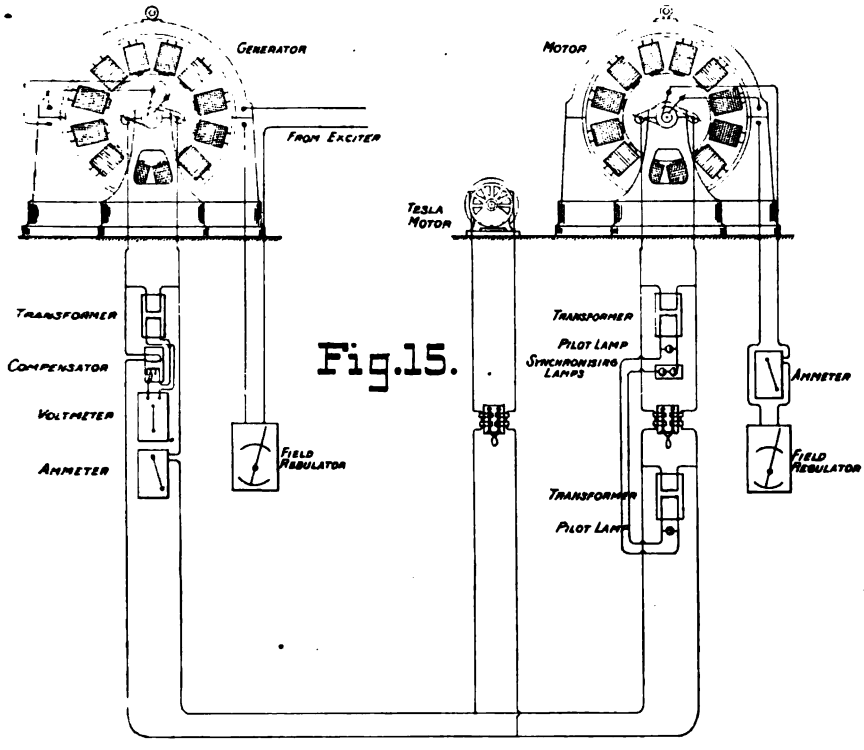

Fig.15.

Synchronous Motor-Plant at Telluride. Diagram showing Apparatus and Connections.

week without adjustment, the exciter brushes run without sparking, and the lubrication of the bearings is well provided for. The construction and operation of the motor are strikingly simple in comparison with the steam engine, which it replaces, with its many moving parts and intricate motions.

"A few points illustrating the characteristics of the synchronous motor may be mentioned, as they are of both theoretical and practical interest. The connection of the motor to the generator is not a delicate operation. If the motor is running above synchronous speed at the time of connection with the generator, it instantly adapts itself to the proper speed. If the motor speed is slightly lower than that of the generator, it may fall into step when the switch is closed, but if it be running considerably slower it will not come into synchronism, but will further decrease in speed. When this occurs, the switch of the large motor is opened and that of the starting-motor is closed, bringing the machine up to full speed again without any injury to the apparatus. If the E. M. F. upon each of the machines before connecting them be 3,000 volts it will remain unchanged when they are connected. If the field-current of either machine be increased, the E. M. F. will be raised, but the field-current of the other machine may be lowered and the resulting E. M. F. made equal to 3,000 volts. The current flowing between the machines depends upon the relative field-charges, and is least, whatever the load may be, when the two machines are equally or very near equally

excited. The field-current of either machine may be made zero, and the motor will still run, but with greatly reduced capacity. In a test with machines of a smaller size the E. M. F. was 2,000 volts when the two field-charges were equal. When the field-charge of either machine was cut out it fell to 1,200 volts and the current increased very considerably.

"The efficiency of the synchronous motor system, leaving out loss in conductors, but including losses in generator and motor in the plant for the delivery of 50 horse-power, was found to be 83½ per cent at full load, and 74 per cent at half load.

"Full load may be thrown on the motor suddenly. In the Gold King mill the stamps, which are operated by the motor, are usually left raised when the plant is stopped, in order to avoid the extra strain of lifting them when the plant is started. It sometimes happens that the stamps are left down and the motor is required to raise them all at once. When the clutch is thrown in, the current indicates that the load is considerably above the normal capacity of the motor, and yet it is started without difficulty or apparent strain.

"The excellent current regulation with different loads, the tendency of the machines to normal adjustment when there is ordinary variation in the field-currents, the small liability to injury when the motor is greatly overloaded, the high efficiency and ease of attendance, are points of great value in the practical operation of the system.

"The pole-line runs from the power station up the mountain to a height of 2,500 ft., and then crosses a rough but comparatively level country to the mill. The line at some places is at an angle of 45°, and many of the poles had to be set in solid rock. The surface of the snow in winter is occasionally at a level with the tops of the poles, and parts of the pole-line are practically inaccessible during some months of the year. This region is peculiarly subjected to lightning discharges, and special precautions are necessary to protect the apparatus. In one instance there were forty-two discharges of the lightning-arresters in as many minutes.

"The plant was started for regular work in June of last year. An accurate record was kept from the middle of July to the first of May, showing the actual number and the length of the delays caused by electrical machinery. During these nine and a half months the system was in regular continuous operation six and a half days each week, with but few intermissions. The difficulties which were encountered were insignificant in amount and have resulted, not from any fundamental difficulty in the system, but have been caused by incidental defects or accidents which usually indicated their own remedy. The stops due to the electrical machinery resulted from a variety of causes, and comprised the replacing of an armature-coil damaged by lightning, renewing of fuses, fixing loose contacts, the examination of the line after a storm, and sundry other slight mishaps. The aggregate time lost on account of the electrical apparatus was, by actual count, less than 48 hours during three fourths of a year. A recent report from the Superintendent of the plant, covering the time from December 13th to May 1st, shows that the plant was running 127 days with a loss of 19¾ hours, or, as he puts it, an average of about nine minutes in a day of 24 hours. Although the plant was generally shut down each week for 12 hours on Sunday, this was not practicable during a part of the winter, and the motor on

Telluride, Colorado.

50 horse-power.

one occasion was run continuously for 27 days without any stop whatever. Such a record as this, with a new type of machinery, in a country where line construction and maintenance are peculiarly difficult, with practically continuous service, with attendants who were not electricians, with a high voltage, a considerable distance and large power, places transmission by the alternating-current synchronous system beyond the stage of experimental trial and gives it the stamp of commercial success.

"This success is confirmed in a substantial way by the immediate extension of the plant. A 50 horse-power motor is now being installed at a mill a few miles from the Gold King; an order has been entered for a 750 horse-power generator to be located in the power station; and a 250 horse-power motor for operating a mill about 10 miles distant. Lighting at Telluride, 8 miles from the station, which has been done heretofore on a small scale on a circuit from the power generator, is being extended.*

"The large generator is a new design and is notable, as it has more than three times the capacity of any alternating-current dynamo previously made in this country. Two machines of this size have been running for some months for incandescent lighting at St. Louis.

"This dynamo is of a type similar to the machines at Portland and Telluride. The field has twenty-eight poles, requiring a speed of 570 revolutions for 16,000 alternations, the conditions of running at St. Louis, and 357 revolutions for 10,000, as it will be operated at Telluride. The armature has T-shaped teeth, as in smaller machines. The diameter of the armature is slightly over 4 ft. and its length is about 2 ft. There is a third bearing at the end of the shaft outside of the pulley to relieve the other bearings from the severe strains resulting from belt tension. The total height of the machine is 8 ft., and its weight is 40,000 lbs. The electrical efficiency at full load is over 95 per cent.

"The extension of alternating-current working, both for lighting and power, by the use of large machines, is therefore already provided for.

"The extension to greater distances is largely a question of E. M. F. Nearly every one is familiar with the rapidity with which the cost of copper diminishes as the voltage is increased. If the cost be $100 with 500 volts, it will be $25 at 1,000 volts, and $1 at 5,000 volts. The higher the tension, however, the greater the difficulty and cost of construction, and the greater the liability to accident with apparatus and line. There are a few points in connection with this subject which may be noted without entering into a general consideration of it.

"The smallest size of wire that can well be used for line work on account of its mechanical strength is about No. 6 B & S. This wire will transmit with 20 per cent loss 100 horse-power 10 miles at 4,000 volts, or twice the power half the distance. Unless these distances or powers are to be exceeded, an increase in pressure would result in no saving in copper, but simply in a less line-loss, which is already not excessive.

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* NOTE, May, 1893.—Since this paper was read the 750 horse-power generator, the 50 horse-power motor, and the 250 horse-power motor have been installed and put in operation. (See Plates VIII and IX.) The order has been placed for an additional 75 horse-power motor. A letter from the engineer of the plant, dated April 20, 1893, contains the following: "The generator runs very nicely indeed. The motors are running very satisfactorily. The 250 horse-power is running very nicely at the present time. The 50 horse-power has been running about a week since the winter shut-down, and the 100 horse-power motor, which has been idle during repairs to the mill, is expected to start within two weeks. When we get the 75 horse-power motor and start it, we will feel that we have quite a system in operation."

"The use of 4,000 volts at the motor and a line-loss of 20 per cent requires an outlay for copper of only about 10 to 15 per cent of the total cost of the plant when the distance is 10 miles. Unless, therefore, the cost of copper is to bear an insignificant proportion of the total cost, it is unnecessary to exceed this pressure unless the distance be greater than about 10 miles.

"These simple considerations show that pressures practically the same as those employed in the plants which have been described are ample for considerable distances. The same type of apparatus which has been successful in them is available for larger capacities. The fundamental elements required for electrical transmission in a very wide range of cases have therefore been tried and their success demonstrated.

"For considerably longer distances, where pressures higher than about 5,000 volts are required, good practice indicates the use of transformers for raising the pressure at the generator and reducing it at the motor, similar in general to those employed at Portland. The increased pressure thus available greatly reduces the cost of copper required, and this reduction must, of course, be more than sufficient to cover the cost of the transformers.

"The simplicity and flexibility and range of the alternating-current system make its possibilities the sole dependence of the largest enterprises toward which the public and engineers are looking. The records of the plants at both Portland and Telluride demonstrate that these possibilities are being realized, and that work in this field is fast passing from experimental investigation into practical electrical engineering."

PROTECTION AGAINST LIGHTNING.

The protection of these circuits against lightning is a very important matter. The mountainous regions in which the majority of mines are located are generally subject to severe thunder-storms and electrical disturbances, and therefore to the miner using electrical power, it is of vital importance to have his apparatus protected from damage from such causes; while many may be deterred from undertaking the installation of electric transmissions through fear of lightning interfering too seriously with their successful operation.

During the past year much trouble has arisen at Bodie from this cause; the machines running smoothly and perfectly for several weeks, when a storm would occur, oftentimes without visible lightning or audible thunder, but causing a burn-out of armature-coils in generator or motor.

Lightning-arrester houses have been built at each end of the line close to the power-house and motor-room, and these fitted up with banks of spark-gap-arresters and choke-coils precisely as outlined by Mr. Alex. J. Wurts in his article on "Discriminating Lightning-Arresters and Recent Progress in Means for Protection against Lightning" (in the "Electrical Engineering Magazine," May 23, 1894), since which time but little trouble has been had.

Our experience was so similar to that of Mr. Wurts with the plant of the San Miguel Consolidated Gold Mining Company, at Telluride, Colo., and so much interesting and valuable information on the subject is given in the above-mentioned article, that the writer takes the liberty of quoting Mr. Wurts in full:

*An Experiment with Lightning-Arresters on a 3,000-Volt Alternating-Current Circuit.**

"During the winter of 1892 and 1893 I made a searching investigation of this subject, experimenting with disruptive discharges and various kinds of combinations of apparatus which might promise advantageous results, and since that time have spent nearly six months in the State of Colorado—a land of thunder-storms—testing the various forms of apparatus which I had designed as a possible protection against lightning.

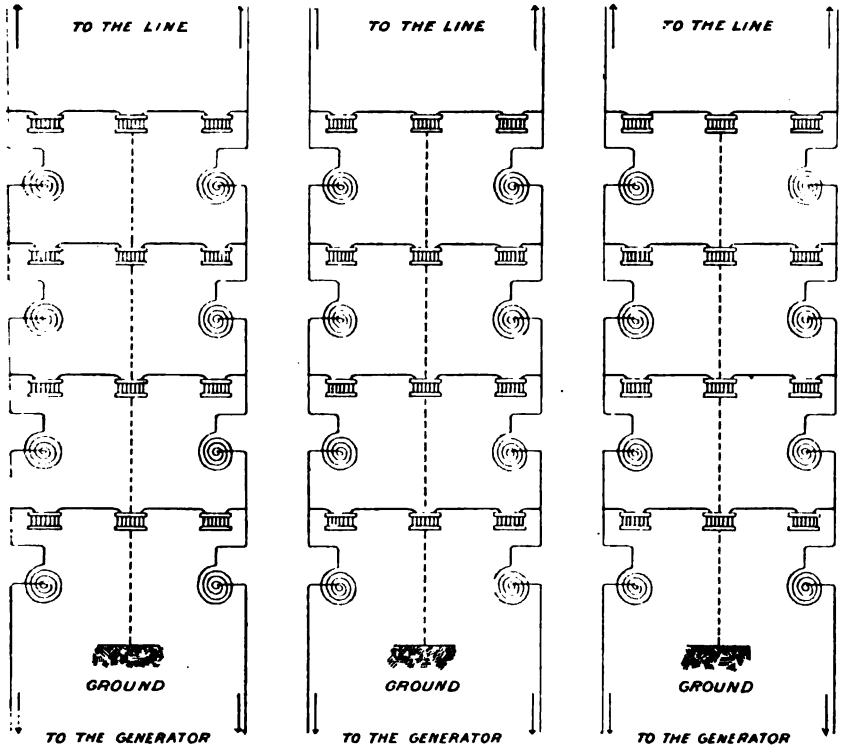


Fig. 16.

"The general requirements of efficient lightning-arrester apparatus are: (1) To provide discharge circuits which shall operate automatically and repeatedly, and which shall with certainty avoid dynamo short-circuits or interruption of the system. (2) To provide discharge circuits, or so install them that they shall invariably offer a certain path to ground for disruptive discharges in preference to any other part of the system. It follows also from this last, and as a matter of practical experience, that ground-discharge circuits should be short and straight,

* Abstract of a paper read at the eleventh general meeting of the American Institute of Electrical Engineers, Philadelphia, May 15, 1894.

and that ground connections should be of the most approved construction. Experiments were therefore made to determine the number of non-arcing metal cylinders and spark-gaps which would be necessary to interrupt a short-circuit on a 3,000-volt alternator with the potential raised to 3,300 volts. Nineteen cylinders, or eighteen gaps, were found to offer ample margin, and the breaking down E. M. F. on half this number of gaps, which would intervene between line and ground, was found to be about 70 per cent of the E. M. F. required to break down insulation ordinarily used in a 3,000-volt generator. The form finally adopted was that of a flat coil about 18 in. in diameter, and wound with seventeen turns of wire; the size of the wire varied, of course, with the carrying capacity of the particular circuit into which it was to be connected. After further experimenting with various combinations of spark-gaps and choke-coils, it was decided that the trial apparatus could consist of eight choke-coils and twelve 1,000-volt non-arcing metal-arresters for each end of each circuit; that is, four choke-coils should be connected in series in each leg of each circuit, with discharge circuits intervening. The relative positions of these parts are clearly indicated in Fig. 16, which represents one end of each of the three circuits. Disruptive discharges form nodal points in the system; that is, points where there will be a minimum tendency to discharge; hence to avoid these with any degree of certainty a multiplicity of arresters, preferably line-

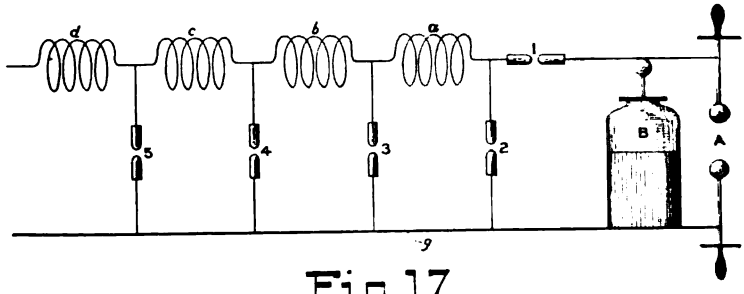


Fig. 17.

arresters, should be used. Choke-coils form points of reflection, or points where there will be a maximum tendency to discharge; hence, a discharge spark-gap connected directly in front of a choke-coil is more likely to receive discharges than if placed at some other point in the system. Disruptive discharges are liable to divide and follow several paths, being governed by a complexity of ever-varying circumstances. For this reason it was decided to connect several choke-coils in series, so that should only a portion of a discharge pass across the first arrester, the balance passing through the first coil, a second opportunity for discharge would be found at the second arrester, which was also connected in front of a coil, and therefore at a point of reflection. Should this remaining portion of the discharge again divide, a further opportunity for discharge would be afforded at the third arrester, and so on, so that by the time the fourth coil was reached it was presumed that the discharge would have spent itself.

"Some of the many experiments made to substantiate this theory are exceedingly interesting as well as instructive. Referring to Fig. 17, A are the terminals of a powerful influence-machine, B is a battery of Ley-

den jars, G a wire which may represent the ground, and is connected to the outside coating of the jars; L is a second wire which may represent one leg of an electric circuit; *a*, *b*, *c*, and *d* are choke-coils connected with the line L, and in series with each other; 2, 3, 4, and 5 are intervening discharge-circuits containing spark-gaps; 1 is a $\frac{1}{32}$ in. spark-gap separating line L from the inside coating of battery B. If now the battery becomes charged from the influence-machine A, a large and violent disruptive discharge will take place across gap 1, and suddenly charge line L. This discharge will then pass to earth G through one or more of the spark-gaps 2, 3, 4, 5, according to circumstances. It will be noted now, that this arrangement of choke-coils and discharge-circuits is similar to that shown in Fig. 16. The spark-gaps were made of rounded $\frac{1}{2}$ in. brass rod adjustable with a $\frac{1}{32}$ in. screw thread. The coils were wound with No. 0000 wire, were 3 in. in diameter, 6 in. long, and contained eleven turns each.

"With these four choke-coils in series, and spark-gaps intervening, the discharges are so thoroughly sifted out that only an occasional thread-like spark finds its way across the last gap. With laboratory results such as these, it seems fair to presume that results more or less similar might also be expected in practice.

"The plant selected for the trial of this apparatus was that of the San Miguel Consolidated Gold Mining Company, of Telluride, Colorado, which is equipped with a 3,000-volt alternating-current synchronous system, of 1,000 horse-power capacity, operating stamping mills, and furnishing current to the Telluride Electric Light Company. These points are situated among the mountains at distances varying from 3 to 10 miles from the power-house. Three separate circuits leaving the power-house extend over a wild and rocky country, and in some places rise above timber line. In previous years every attempt to protect this plant from lightning had failed. During the summer months two horses were kept constantly saddled ready for emergencies consequent on lightning discharges, and at the motor and power-house it was common practice, on the approach of a thunder-storm, to lay out, ready for instant use, an extra armature-coil, with all the necessary tools for handling the same. In one of the former types of arresters used in this plant forty fuses were blown inside of sixty minutes.

"The apparatus was then installed in a specially constructed and weather-proof lightning-arrester house, the arresters and choke-coils being mounted on thoroughly dried wooden frames, and every precaution taken to insulate these from the ground and from each other. In this manner, also, it was expected that the lightning discharges would be kept entirely out of the station. The connections inside the power-house lightning-arrester house are all clearly indicated in Fig. 16. One main B. & S. No. 3 ground-wire was used for all the arresters in each bank, unnecessary kinks and bends being studiously avoided.

"Observations were taken by competent men at each bank of arresters during the entire lightning season, and the results obtained indicate that the discharges occurred most frequently over the second arresters; many passed over the third arresters; very few, however, over the first or fourth. The writer personally watched one of these banks of arresters through severe thunder-storms, and in every instance the discharges noticed by him were seen to pass across the second series of spark-gaps, but in no instance was there a fuse blown or damage done to the arresters."

The matter of proper earth connections at the terminals of the ground-wires from these lightning-arresters is most important. The common idea that a rod of iron stuck into the earth a couple of feet, or a piece of old iron thrown into the bed of a stream, forms a good "ground" is most erroneous, as has been proven by our experience at Bodie. In reality, such form the poorest kind of earth connection.

The ground-wires from the banks of arresters are carried into a pit dug directly underneath the arrester-house. This pit is about 4 ft. square and reaches to permanently moist earth at the power station, while at the mill, since no damp ground was found at a reasonable depth, it was necessary to carry a ¾ in. pipe into the pit through which water is occasionally allowed to run. On the bottom of the pit a layer of small charcoal 2 ft. in depth was laid, and on this placed a plate of copper $\frac{1}{16}$ in. in thickness and 6 sq. ft. in area. To this plate the ground-wire was securely soldered in a spiral coil, and another layer of charcoal placed on top of it, after which the pit was filled up with loose dirt. This makes an efficient ground, and gives the necessary surface for the rapid dissemination of the electric discharge.

Inductive resistance-grounds have also been added at either end of the line, with the object of preventing damage to the machines through static charges, by leaking them to earth as fast as accumulated. They are connected to each side of the line as shown in sketch, and their resistance is sufficiently high to prevent any appreciable loss of current.

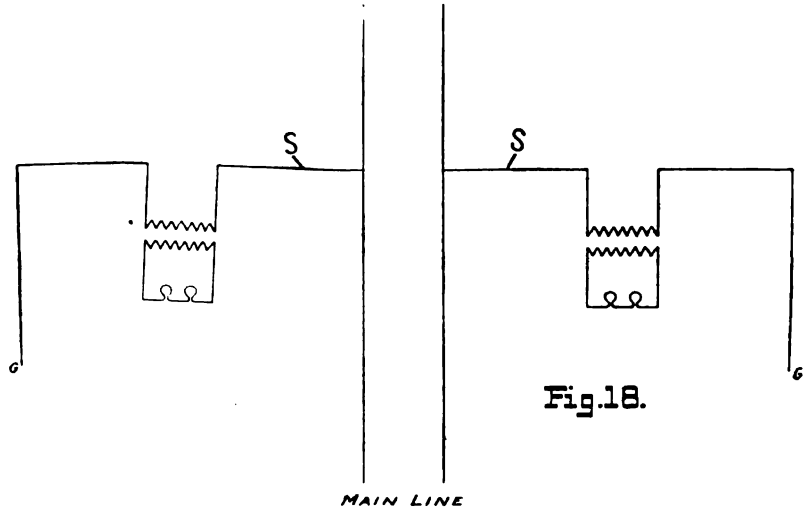


Fig.18.

Two 50-volt lamps in the secondary circuit of each "resistance" burn at a dull red when the switch S is closed; as is the case at all times excepting during thunder-storms. During such these grounds are taken off in order to prevent danger of burning out the primaries.

These inductive resistances are chiefly of service during wind-storms, when the line is most liable to cumulative charges from the atmosphere.

ELECTRICAL TRANSMISSION PLANTS AT PRESENT IN OPERATION.

The following short descriptions of electrical power plants in operation have been culled from various sources, many of them from the article by W. H. Adams in "Engineering and Mining Journal," June 23, 1894:

Electric Generating Station at Tivoli.—In a lecture delivered by Prof. J. A. Fleming, at the Royal Institution, the following description was given of a plant used in transmitting 2,000 horse-power from the Falls of the Anio, Tivoli, for 18 miles over the Campagna to Rome: "From the upper levels of the Anio an aqueduct has been led which delivers water to the top of an iron pipe 150 ft. above the power-house. This power-house is placed about halfway down the declivity on which are situated the famous cascades of Tivoli. The pipe is about 2 meters in diameter and can deliver 100 to 150 cu. ft. of water a second with a head of 150 ft., or nearly 2,000 horse-power. The water is conducted to a series of nine Girard turbines, six being of 350 and three of 50 horse-power. The six larger ones are directly connected with Ganz alternators, which generate a current of electricity at a pressure of 6,000 volts, while the three smaller ones are used to drive the exciters. The current is conveyed to Rome by four cables carried on 760 posts, which are placed in a straight line across the Campagna. Outside the Porta Pia, at Rome, it enters a transformer-house, where its pressure is reduced from 5,000 to 2,000 volts. Part is then used for arc lighting in the streets of Rome, and the rest is distributed by underground cables to various other centers, where it is again transformed down to a pressure of 100 volts for use in houses. About 20,000 incandescent lamps are thus supplied with current."

Compagnie de l'Industrie Electrique, Geneve, Switzerland.—Four hundred horse-power transmitted 20 miles by continuous currents, potential between 6,000 and 7,000 volts. One 400 horse-power turbine, under fall of 14 meters, revolves on vertical shaft at 120 revolutions per minute, and drives by means of bevel wheels and pinions two dynamos, placed one on each side. Commercial efficiency of the dynamos reaches 93 per cent, with a weight less than 7½ tons. Commercial efficiency of the installation from shaft of the turbine to the motor shafts exceed 75 per cent at full load. Bare copper conductors are used in line construction, 7 millimeters in diameter, the line being entirely aërial through mountainous country between Frinvilliers and Bieberist.

A plant at *Oynuax, France*, has been working satisfactorily for some time with two turbines of 150 horse-power each. A generator of 105,000 watts capacity at 2,000 volts is directly connected to each turbine. Distance between generating and receiving station about 8 kilometers, and 76 per cent efficiency is obtained in the transmission.

At *Chambery*, 2,000 horse-power is about being installed with waterfall 2,040 ft. high. There are to be seven alternators, each of 120 kilowatts at 5,000 volts.

The two waterfalls about 25 miles from *Christiania, Norway*, are about to be utilized for power transmission, at a total cost of $1,500,000. The voltage will not exceed 20,000, to be carried on bare wire on poles carefully guarded over the entire distance.

The *Portland General Electric* power plant, at Oregon City, Oregon, 12 miles from the city of Portland, on the Willamette River, will install 12,000 horse-power, using twenty Victor 42 in. and twenty Victor 60 in.

turbines, under 30 and 48 ft. head. Many new features in tri-phase transmission are promised for this plant, one half of which is now being installed for service during the coming year.

In the Baltic mill, on the Shetucket River, about 5 miles above *Taftville, Connecticut*, the General Electric Company has lately installed a three-phase power transmission plant of 1,500 horse-power, using three double 42 in. horizontal turbines, developing 800 effective horse-power each at 157 revolutions per minute, and one double 27 in. turbine developing 300 horse-power at 244 revolutions per minute.

The efficiency is just 80 per cent from power applied to dynamo pulley to delivery at motor pulley at *Columbia, South Carolina.* The Columbia Cotton Mills Company is about starting a plant of 1,400 horse-power, using two pairs of 48 in. Victor turbines on a horizontal shaft, and a single 24 in. turbine for fire pump. The 48 in. turbines are connected together, and at each end are directly connected to a generator of 700 horse-power capacity. This is the second instance in this country where an entire cotton mill is driven by electricity. The generators, made by the General Electric Company, weigh about 100,000 lbs. each; the armature is 10 ft. in diameter, 500 kilo-watts capacity, and operates at a speed of 108 revolutions per minute.

Concord Land and Water Power Company, Concord, N. H., has utilized 2,000 horse-power of the 5,000 horse-power, furnished by the new dam located at Sewall's Falls. Horizontal turbines are used with draught tubes, thus avoiding gears, the power being transmitted from each pair of wheels to the shafting in the generator-room by belts. The shafting is arranged with quills and clutches, in order that any wheel or section of shaft may be run independently of any other. The pulleys used on shafting are extra heavy, and fly-wheels are being tried for the first time at this location for inertia regulation. Six tri-phased generators are to be installed, two being now in operation, of 250 kilo-watts capacity and separately excited, and run at a speed of 600 revolutions per minute. The current is generated at 2,500 volts; the line runs to the center of the city, about 3 miles, where tri-phased current of a frequency of 50 is delivered to the mains at 2,200 volts pressure. It is then transformed to 110 volts for delivery to consumers, being sold by meter at 20 cents per kw.-hour for lighting and 10 cents per kw.-hour for power, heating, and cooking.

Colorado.

The Roaring Fork Electric Light and Power Company, Aspen.—Pipe-line, 500 ft. of 16 in., 3,500 ft. of 14 in. Power plant: eight 24 in. Pelton wheels, 1,000 revolutions, under a head of 820 ft., equal to 175 horse-power each; total, 1,400 horse-power. The light plant supplies the entire town of Aspen, as well as many mills, mines, and sampling-works. The power plant supplies 120,000 watts, and is used for operating mills, hoists, pumps, and tramways within a radius of 3 to 4 miles from the generating station. The plant has been in continuous operation for five years, with practically no expense in the way of repairs or interruption of the service.

Aspen Mining and Smelting Company's Plants.—Flume, 1,300 ft. long, head 80 ft.; two 50 horse-power Thomson-Houston dynamos, equal to 100 electric horse-power; generating station, 6,000 ft. from tunnel entrance. The underground motors are located 1,000, 1,200, and 1,800 ft. from the entrance. Power used for hoisting.

New works of the *Roaring Fork Company.* Two pipe-lines: 2,500 ft. of 26 in. pipe, head 312 ft.; 4,300 ft. of 24 in. pipe, head 330 ft. Power plant: five 60 in. Pelton wheels, 30 revolutions, 250 horse-power each; total, 1,250 horse-power. Distributes power 5 miles distant.

People's Electric Light and Power Company, on Castle Creek, 1 mile from Aspen. Power plant: two 5 ft. double-nozzle Pelton wheels, 300 horse-power each, 240 revolutions, 180 ft. head; also two 3 ft. double-nozzle Pelton wheels, 75 horse-power each, 345 revolutions. Power and light furnished to mills and mines within a radius of 3 miles.

Virginius Mine Plant.—Pipe-line, 4,000 ft., head 485 ft. Power plant: two Pelton wheels, one 5 ft. and the other 6 ft. in diameter, 500 and 700 horse-power, respectively; total, 1,200 horse-power. Electric generating plant: 293 horse-power; line, 4 miles long. Machinery operated at the mines: 2 pumps (one 60 horse-power and the other 25 horse-power), one 15 horse-power blower, two 60 horse-power motors for running concentrators and stamp mills. Previous to installation of the electric plant the outlay for coal alone was $40,000, at $18 per ton.

Telluride—San Miguel Consolidated Gold Mining Company's Plant.—Power plant: 6 ft. Pelton wheel, 3,900 ft. of 24 in. pipe-line, 320 ft. of head; 1,100 horse-power dynamos, supplying power to three stamp mills, 2, 3, and 10 miles distant, and also lights for the town of Telluride, 8 miles distant. The pole-line is 8,800 to 12,000 ft. above sea-level. The cost of maintenance, including wages at power plant, was given at $3,060 for the first year. The repair account was $21, occasioned by lightning. Since the introduction of lightning-arresters there has been no damage from this cause.

Sheridan & Belmont Company.—Water-head, 235 ft.; Pelton wheel, 28 in.; electric circuit, 12,300 ft., furnishing 250 to 300 lights, and two motors of 10 horse-power and 5 horse-power.

Belmont Consolidated Mining Company.—Head of water, 670 ft., capable of developing 210 horse-power, with a 36 in. Pelton wheel. In the mine are two 30 horse-power motors. Length of line, 2 miles. Loss between generators and motors, 8 per cent.

Washington.

Walla Walla Electric Power Plant.—Pipe-line, 5,800 ft. of 48 in. pipe; two 80 in. Pelton wheels; two A-100 Edison 2,000-volt machines.

Idaho.

Cœur d'Alene Silver and Lead Mining Company.—Pipe-line, 3,000 ft.; head, 850 ft.; two 3 ft. double-nozzle Pelton wheels. Has replaced all steam machinery at the mine, with a saving of $40,000 per year.

Mr. Clark, General Manager of this company, writes in reference to this plant as follows: "In respect to the relative merits of steam and electricity at the Poorman Mine, I will say that the amount saved in fuel is about $100 a day. This, of course, is due to the fact that we generate electricity by water power. How electricity would compare with steam in the matter of cost, if the former was generated by steam power, I am not prepared to say, but am of the opinion that where steam has to be transmitted a long distance underground, particularly where it is wet, that electricity generated with steam and transmitted to the pumps or other machinery will be found to be the most econom-

ical, the percentage of loss in transmission being so much less; in addition to this, the cumbersome steam pipes, with their destructive effect on shaft timber, is avoided. We have five machines in use: two 175 K.-W. at the generating station 1½ miles distant from our works, where they are operated with Pelton wheels under 800 ft. head; one 175 K.-W. to drive our concentrator; one 150 K.-W. T.-H. machine for the pump, raising 500 gallons of water per minute 500 ft.; and one 175 K.-W. for the compressor. This system has been almost two years in operation, and my experience in that time is that an electric machine to run continuously, as in operating a mine pump or mill, must have at least double the capacity it would require when stops occur—as on a street car, for example."

The greatest departure, however, electrically, is the installation at this mine of an 80 kilo-watt, *1,200-volt* motor for driving a Knowles double-acting pump, having a capacity of lifting 500 gallons 500 ft. high per minute. The current for the motor is conducted down the shaft through which all the steam pipes, air pipes, etc., are taken, by two Siemens (lead, iron band, iron wire, armored) cables—C. L. A. T. W. The iron wire armoring of these two cables is so connected and arranged as to prevent any shocks due to static charges, should workmen come in contact with the cables.

The regulation of the speed of the motor is effected by placing in armature-circuit of motor a rheostat of two or three ohms capacity. The motor drives the pump through a counter-shaft and wooden-toothed gear and bronzed pinion. The crank-shaft of pump makes from 36 to 46 revolutions per minute as desired.

This is the first installation of a 1,200-volt motor placed in a mine for pumping purposes. The mine and mill are lighted by incandescent lamps from a 110-volt Edison dynamo belted from main shaft of mill.

California.

The Dalmatia Mine Plant in El Dorado County.—The power station is located on Rock Creek, some 1,500 feet below the mine and mill, and 2 miles distant in a straight line. The plant consists of an 8 ft. Pelton wheel, which, running under a head of 110 ft. at 100 revolutions, with a 5½ in. nozzle, has a maximum capacity of 130 horse-power. To this wheel is connected a 100 horse-power constant-current Brush generator—30 amperes—speeded at 900 revolutions, the current from which is carried to the mill through a single insulated copper wire, No. 3, B. & S. gauge, the return being made by a wire of the same size, making a 4-mile circuit. The power from the generator is communicated to the counter-shaft of the mill by a 70 horse-power motor running at 950 revolutions. The machinery operated consists of three Huntington mills, a 10-stamp battery, and a rockbreaker. The Pelton wheel under these conditions shows an efficiency of 86 per cent, while about 75 per cent of the power thus generated is available for duty at the mill. Sufficient power is taken from the main circuit to run sixty incandescent lamps for lighting the works, office, and residence of the manager. The mill handles an average of 4,000 tons of ore a month, effecting a saving of some 60 per cent over the former method of working by steam power, while the cost of maintenance is about as six to one in favor of electricity. An extension of this line has recently been made to the St. Lawrence

Mill, similar in character to the Dalmatia—located 3 miles from the latter and 5 miles from the waterwheel station—which is operated by Keith generators and motors. This is an exceptionally long distance for a continuous-current transmission.

The San Antonio Electric Light and Power Company in Southern California.—The power plant is located in San Antonio Cañon. The water is brought to the power station through 1,900 ft. of 30 in. and 600 ft. of 24 in. double-riveted sheet-iron pipe, giving 300 ft. effective head or running pressure. The power station is provided with four double-nozzle Pelton wheels, 34 in. in diameter, coupled direct to the armature shafts of as many Westinghouse alternating-current generators of 200 horse-power each. The wheels run under above conditions 600 revolutions per minute, giving the same speed to the generators. Two exciters are provided, which are also run by Pelton wheels coupled to the shafts in the same manner, and of 20 horse-power each. The current thus generated is carried on two No. 7 bare copper wires 7 miles down the cañon to a point where they diverge, one running to Pomona, 15 miles, and the other to San Bernardino, 28 miles, covering by the return circuit in the latter case a distance of 56 miles. By means of transformers the potential is raised at the generating station to 10,000 volts, and the current carried at this pressure to sub-stations located just outside the cities named, where, by means of step-down transformers, it is reduced to about 1,000 volts and then distributed for both light and power purposes.

Amador County—The Gover Plant.—A 3 ft. Pelton wheel, 340 ft. head, speed 470 revolutions, works two Dow pumps of 15 horse-power and 20 horse-power, which handle 200,000 gallons of water per day.

Plant at Redlands, San Bernardino County.—This is a three-phase plant, recently installed by the General Electric Company; distance of transmission, 5 miles; two A. C. generators, of 250 K.-W. each, driven by four 30 in. Pelton waterwheels, at a speed of 600 revolutions. The generators carry a potential of 2,450 volts and the motor about 2,150, the line-loss being approximately 12 per cent. The three No. 0, bare copper wires (insulated within city limits) are carried on deep-groove, double-petticoat glass insulators. The line poles are 35 ft. long, 6 ft. in the ground, and set 110 ft. apart. The one motor at present in operation is a synchronous high-potential machine of 150 horse-power, and has continuous work to perform in driving the ice machines of the Union Ice Company. The initial current in the fields of the motor is generated by a small exciter, and the motor is self-starting only under light load, the full load being thrown on after the machine is up to speed.

Nevada.

The Chollar Plant.—This, one of the earliest applications of electricity to mining work, has already been so fully described in the mining and technical papers that it is not necessary to repeat the details.

Arizona.

Plant of the Commercial Mining Company.—This plant consists of a 4 ft. Pelton wheel, which runs, under a 1,200 ft. head, at 699 revolutions a minute, developing 45 horse-power, using a nozzle tip $\frac{53}{100}$ in. in diameter; also a 24 in. Pelton wheel running, under the same head, at 1,380 revo-

lutions, developing 20 horse-power, with a nozzle tip $\frac{35}{100}$ in. diameter. These wheels run a concentrating and smelting plant, including rock-breaker, blowers, pump, etc. The pipe-line is 20,000 ft. in length, the upper end being 6 and 5 in. casing, and the lower end 5 in. lap-weld pipe.

ELECTRICITY IN UNDERGROUND OPERATIONS.

This power was applied earlier and has been more widely used in the coal measures than in lode or precious metal mining; hence, in the former we find many coal mines fitted with extensive and efficient electric haulage systems and lit by electricity, while their drills and coal-cutters are operated by the same power.

Electric locomotives are now built no larger than the cars they are to haul, and made to conform to any gauge of track from 18 in. upwards, effecting a great saving in the size of entries required for narrow coal seams. That they do not vitiate the air as do steam motors is a great point in their favor.

For the operation of undercutting machines, haulage, and general coal mining work, the direct-current is usually employed, since it can be generated cheaply at the pit's mouth, and the underground workings are not usually of such length as to increase unduly the cost of conductors.

It is not invariably employed, however, as instanced in the First Pool Mines at Benola, on the Monongahela River, where an A. C. three-phase plant was installed several years ago. The generator is of 100 horse-power, Tesla type, operating under 500 volts. The three wires are carried underground for 2½ miles along the main entry. Clark's insulated wire, No. 2, is used, and branches are carried to the various chambers to operate McMichael's undercutting machines working in the bituminous coal-seam from 6 to 8 ft. wide. The current is used for lighting also, in 16 candle-power incandescent lamps.

New electric coal-cutters are continually being put upon the market,* and the improvement in these machines and the introduction of electric pick-machines for hard coal, typifies the rapid advance in the application of electricity to mining work.

In metal mining, electricity has thus far been employed chiefly for pumping and hoisting, though its field will undoubtedly be greatly extended within the next decade.

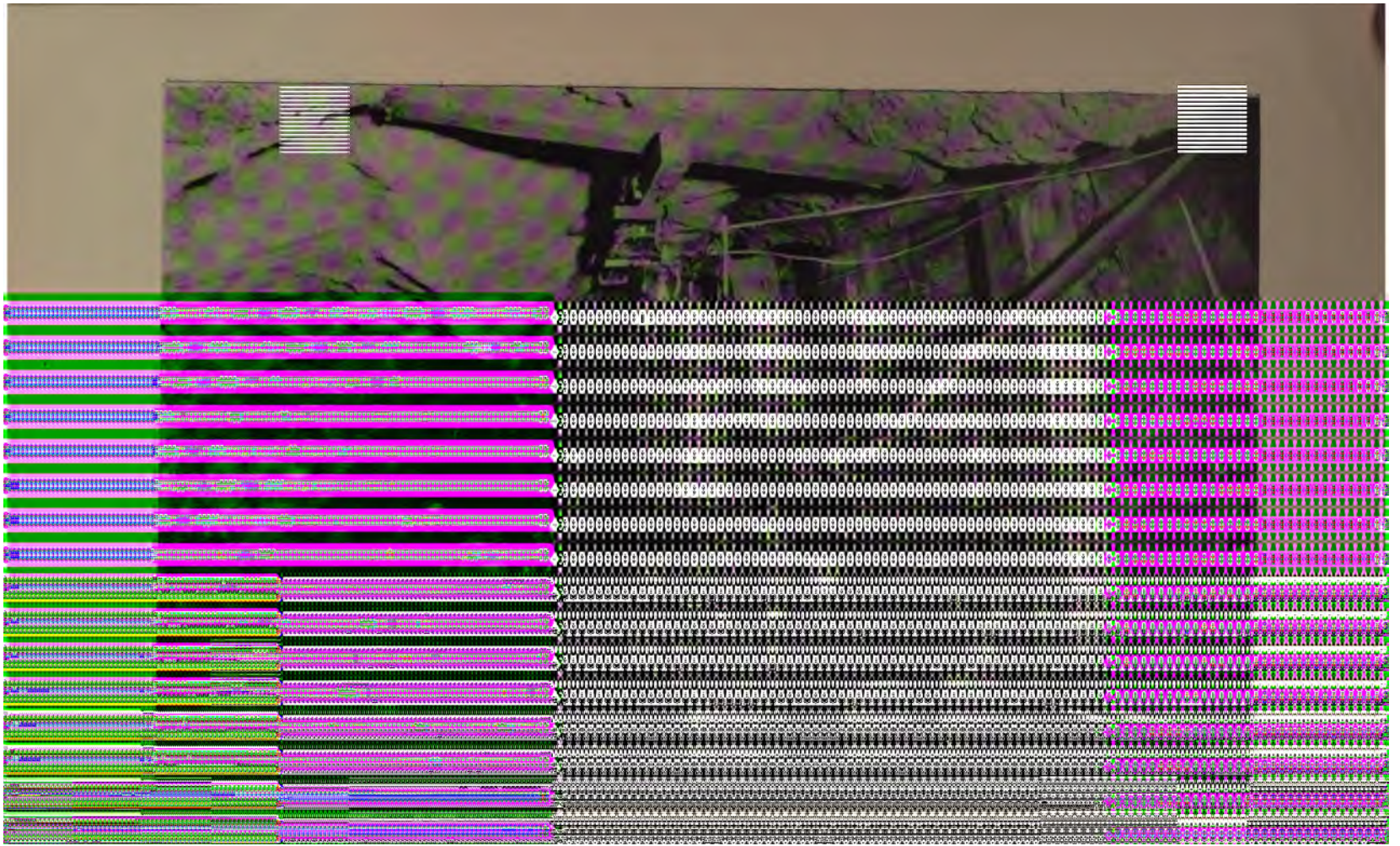
While it is reported that electric percussion drills are at present in successful use, and exposed to the same hard usage as the air drills,† the writer has not yet been fortunate enough to witness such nor to obtain details of their operation underground.

The use of electricity, however, certainly admits of a great saving in the transmission from air-compressor to drills, by the placing of the former underground and closer to the stopes and headings.

That motors are now made that will operate as successfully underground and in damp places, as upon the surface, is conclusively shown by the number of pumps at work in wet shafts to-day. By this it is not meant to say that wet electric motors will operate, but that these are now so insulated and protected that they successfully exclude the moisture of wet shafts and damp foundations.

A most excellent instance of this we have at hand in Superintendent

* See "Engineering and Mining Journal," June 16, 1894, p. 559.
† Trans. Am. Inst. M. Engineers, vol. xxiii, p. 405.



Call's letter to the writer, descriptive of the Gover Mining Company's (Amador County, Cal.) plant, as follows:

"Two triple-plunger Dow pumps are used—one with 6 in. plungers raising 12½ miner's inches of water 341 ft. vertically, and one with 5 in. plungers, raising 11 miner's inches of water 208 ft. vertically.

"An Edison dynamo, No. 16, of 50 horse-power capacity, is used, and run at a speed of 820 revolutions per minute, the voltage being 220.

"Sprague motors are used. The one working the larger pump is run at a speed of 1,000 revolutions per minute, giving 20 horse-power; and the other is run at a speed of 1,250 revolutions per minute, producing 15 horse-power. The voltage in the motors is the same as that of the dynamo.

"Copper wire $\frac{5}{16}$ in. in diameter transmits the power from the dynamo to the motors, a distance of about 1,700 ft.—1,000 ft. on the surface, and 700 feet down the shaft. (See Plate X.) The wires cause no trouble whatever in the shaft, retimbering even being done without stopping the pumps. The shaft is quite wet in places.

"The pumps have run three years and four months, pumping during that time 59,000,000 gallons of water.

"The armature of the dynamo burnt out once, owing to injuries received in shipment, the core being shifted. The commutator of the dynamo is turned down about once a year.

"The motors are connected with the pumps by gearing. Rawhide pinions are used on the armature shafts. The rawhide pinions last a year, and are more reliable and more satisfactory than those made of bronze.

"With the motors, the only precaution taken against dampness is a thorough coat of paraffine paint. The smaller motor was run at one time for several hours with the field piece half way under water."

In hoisting, electricity has thus far been applied chiefly to inclines and used in motors of comparatively small capacity or from 10 to 40 horse-power, but its field will undoubtedly be extended to vertical shafts and larger machines as its advantages become more widely recognized.

In the mines of the Aspen Mining and Smelting Company, at Aspen, Colorado, three hoists are in operation underground, each of the two main hoists raising 250 tons up a 60° incline 250 ft. long every twenty-four hours. A 25 horse-power motor in use there raises 3,000 lbs. up a similar slope 275 ft. per minute, and is capable of making the round trip from a depth of 550 ft. in three minutes.

This plant was installed three years ago, and direct-current machines are used throughout. The rapid development of the A. C. systems during the past few years has demonstrated the advantages of the two-phase current for both transmission of the power and the accomplishment of a variety of work at the delivery end of the line.

This is shown in the following description from the "Colliery Guardian" of the recent installation of such a plant at the Decize collieries in France. A noticeable feature, and one already alluded to as a decided advantage of the system, is the ready regulation of varying load on the two currents:

"One of the most interesting cases of the electrical transmission of power for coal-mining purposes in Europe has been completed and set in operation at the Decize collieries, in the Nièvre Department of France, and which are owned by MM. Schneider & Co. This installation is remarkable from the fact that diphase alternating-currents are employed

for the transmission, and diphase alternating-current motors are used for reconverting the electrical energy into mechanical power at the different pits. In designing this plant the problem to be solved was to erect a central generating station for the distribution of electrical energy at the different pits where it could be utilized in electro-motors for operating ventilating fans, hauling machinery, pumps, and for lighting purposes. A general idea of what had to be accomplished is shown in the annexed table:

Site.	Distance from Generating Station—Yards.	Electrical Machinery or Lamps Receiving the Current Transmitted.
1.—West.		
Puits des Chagnats	5,090	30 horse-power electric motor.*
Fendue des Lacets	3,466	30 horse-power electric motor.*
Puits des Coupes	2,058	30 horse-power electric motor.*
Puits des Zagots	1,084	Electric hauling machine of 15 horse-power.†
2.—Generating Station.		
Various installations		Six arc and 100 incandescent lamps.‡
3.—East.		
Fendue des Marizy	1,300	30 horse-power electric motor and 24 arc lamps.§
Sorting and washing shops of the Pré-Charpin	2,490	500 incandescent lamps of 16 candle-power.‡
Champvert	3,250	12 horse-power electric motor.

* Used for ventilating fan. † Inclined plane. ‡ Lighting. § Ventilating fan and lighting. ‖ Pumping.

"The generating station is situated, respectively, at distances of from 3.1 miles and 1.86 miles from the extreme points which have to be supplied with current. It contains a battery of six boilers and two units (steam engines and dynamos), each of a capacity of 100 kilo-watts; a further unit will shortly be laid down. The two units may be worked singly or in parallel. The engines are of the horizontal non-condensing type, running at 200 revolutions per minute, and driving the diphase alternators by means of belting. A notable feature in this connection is the fact that each electrical unit comprises a twin alternator, or in reality two machines, placed one at each end of the shaft, the driving pulley carrying the engine belt being arranged in the middle of the shaft. Of course, in a case like the present, where current is employed both for lighting and for power purposes, one of the circuits may become more loaded than another, and in this event the equilibrium must be established by varying the ratio of the electro-motive forces. The arrangement adopted in the Decize installation allows of this being accomplished, as each of the two circuits having a distinct field, it is only necessary to vary the exciting current by means of rheostats to get the desired effect. The generators introduced are Zipernowsky ten-pole alternators, with revolving field magnets. The ten-field magnets are connected together in series, and the exciting current is led to them by means of two metallic rings carried on an extension of the driving shaft on the opposite side to that of the driving pulley—that is to say, on an outer extension of the shaft. Two ordinary brass brushes press upon these rings, to which the exciting current is furnished by a direct-current dynamo. This latter machine is operated by a belt from the shaft of the alternator. At 900 revolutions a minute this direct-current dynamo supplies the

exciting current for the twin alternator, being between 25 and 30 amperes at 110 volts. The fixed armature of the alternators is formed of ten coils, any one of which can be withdrawn and replaced with little trouble.

"After passing through the switch-board, the current is transmitted mainly by means of overhead wires to the points of utilization, the only portion laid underground being toward the end of the principal line leading to the Chagnats pit. The wires forming the overhead line are of silicon-bronze, and are carried on porcelain insulators attached to poles 24 ft. high. The diameter of the wires constituting the principal line to the western part of the district is 6 mm., and 4 mm. in the case of the remainder of the line. It is noteworthy that the same poles carrying the transmission wires also support telephone wires, the latter being arranged 12 ft. from the ground. In order to counteract the effects of induction in the telephone wires, the line conductors are crossed at distances averaging 540 yds., and by this means the difficulty of understanding conversation along the telephone wires which use the earth as return, has been overcome. The small portion of underground line forms a lead-covered cable, laid in a wooden conduit, as also does the telephone line for the same distance. Suitable lightning conductors are provided at the generating and distributing sub-stations and at intervals along the line. The electro-motors at the sub-stations, where the current is utilized for the different purposes mentioned in the table given above, are of the same type as the generators. These diphase motors are easily set in operation, and are to all intents and purposes left to themselves for several hours together. The only attention they receive is the visit of an employé every six or eight hours to ascertain whether the motors are working properly. The sub-stations are situated in the forest, and the facility of working on this system as compared with the erection in each place of a boiler, steam engine, and ventilating fan, is considered to be remarkable, apart from the question of the cost of transporting fuel."

The advantages of electric power both above and under ground, in point of cleanliness, compactness, ease of transmission, etc., have been so often dwelt upon that it is only surprising they have not been more often availed of by miners everywhere. The next decade will undoubtedly see a wonderful development in the application of electricity to mining operations.

RED ROCK, GOLER, AND SUMMIT MINING DISTRICTS, IN KERN COUNTY.

By HAROLD W. FAIRBANKS.

These districts lie in the Mojave Desert, in the northeastern corner of Kern County. At the time of the Bureau's examination they had been known for a little over a year. The placer deposits found in them lie along a line of hills or mountains which extend away from the Sierra Nevada at a small angle, beginning some miles east of Tehachapi and keeping a more easterly course than the main Sierra. These mountains are cut through in places by washes or gulches emptying southward into the sink of Desert Springs Valley. Mainly confined to the north side of this line of hills is a series of beds of conglomerate, sandstone, volcanic tufas, and lava-flows, dipping away from the range at an angle of 20° to 25°. The conglomerates at the base are free from volcanic pebbles, but consist of many kinds of rock, some of which are foreign to the district. These are quite firmly cemented and are followed upwards by friable sandrock and volcanic beds. This is evidently a deposit on a marginal sea or lake bottom which has been elevated from the south and tilted northward. This elevation is greatest on El Paso Peak, where it is nearly 5,500 ft. Jaw Bone, Red Rock, and Goler cañons, with lesser tributary cañons emptying southward, have cut these beds to a great depth. It is in these cañons and on the hills bordering them that the most of the placer gold is found. At the Summit, the easternmost district, the sandstone covers up the underlying metamorphic bedrock, and in the shallow washes draining southward from this sandstone the gold is found.

These facts all point to an original sea beach on which the gold was collected by various means, decay of rocky strata, wash of streams, etc., and that afterwards an elevation took place, followed by erosion of the present gulches, in which the gold has concentrated from the old conglomerate and sandstone. Many modifying agencies have been at work, but this seems to have been the general history. But little evidence has yet been found to show the original source of the gold. It may have been derived in part from the line of mountains on which the conglomerates rest, for a number of small veins of gold and silver have already been found. In the vicinity of Red Rock the porphyry is much mineralized over large areas, but it is not known whether it carries gold. Perhaps the richest gulch on the north side of the range, which between Red Rock and Goler is known as El Paso, is the Bonanza, which lies about 2 miles east of Red Rock. Here, as in the other gulches, the gold is found in the wash from the basal conglomerates and lava tufas. It is found not only in the gulches, but on the slopes of the hills several hundred feet above, and in the wash from the sedimentary deposits rather than from the crystalline rocks. In fact, only traces of gold are found in those gulches which head on the south side of the range or which lie above the conglomerates and other sedimentary formations.

rn County.

County

As this sedimentary formation is followed away from the range it becomes finer and is found to carry only a trace of fine gold. The exposed gold-bearing strip is perhaps half a mile wide. The gold is coarser and more abundant in those gulches which have eroded to the base of the sedimentary series. There is no possibility that these deposits are due mainly to river action, though that may have modified them somewhat. The conglomerates appear along this line of hills, in places overlaid by lava flows, as far west as Tehachapi, and are said to carry a little gold nearly everywhere. West of Red Rock no nuggets have been found. But little float quartz is found in the gravels, although small particles are often found adhering to the gold. Hundreds of claims have been taken up in the region about Red Rock, though but few of them have been worked. Water is needed to make these camps very successful, for although a few of the gulches are very rich, many are not sufficiently so to pay for using a "dry washer." There are said to be hundreds of acres which it would pay to sluice if water in sufficient quantity could be obtained.

The next gulch east of Red Rock is the Last Chance, which heads in El Paso Peak and opens southwesterly across the range. Gold is found sparingly distributed over much country along this gulch, and is more difficult to obtain, owing to the great depth of the wash in many places. In places in this gulch and its tributaries the gold is found on a sandstone bedrock, and in others in different layers in the gravels. Claims have been located for several miles, but owing to the scarcity of water but little is being done. On the east of El Paso Peak head the western branches of the big cañon which crosses the range at Goler. Colorado Camp is situated on one of these gulches. The mountains at this point consist of slate, quartzite, and jaspery rocks, much reddened by the presence of decaying iron sulphurets. In the clays and sandstones which rest against these rocks, and which are brilliantly colored, gold is found in paying quantities. It is also to be found on the decomposed hillside above.

Near the mill site of the Pomona Company prospects of coal have been found in the sedimentary series which here consists of shale, sandstone, and some conglomerate. The past winter a shaft was sunk over 100 ft., but no extensive body found. The seam, as exposed near the surface, has a thickness of 14 in., and dips north in a direction similar to the other portions of the sedimentary series. The bed is, however, at this point purely local, as it is surrounded on all sides by the metamorphic rocks. If the miners who spent several months of work here had had any knowledge of geology they would have known better than to expect a paying seam in such a position. This formation, judging from the fossil leaves found, as well as the condition of the coal, is not older than the Miocene-Tertiary. Prospects of coal have been reported in this same formation a mile or more to the north.

The Goler camps are situated at a depression of the range where a big cañon cuts through it, draining the sedimentary formations farther north. The Benson and Reed gulches, which were first discovered and in which the big nuggets have been found, empty into the big cañon at its junction with the desert plains. These gulches are filled with volcanic and other bowlders, but do not head across the range. In Reed Gulch the $1,000 nugget was found. Just north of these rich gulches there are others much deeper and which empty into the big cañon. In these the bedrock out-

crops in places; in others on the very irregular surface of the bedrock there is a thickness of nearly 100 ft. of a cemented bowlder conglomerate, many of the granite bowlders being 4 to 6 ft. in diameter. In the latter gulches the pay is also fairly good. The gold appears to be present as a concentration from the conglomerate.

At the Upper Goler camp, 2 miles above the lower, mining is also carried on along the slope of the mountains on which the sedimentary formations rest. Many shafts have been sunk in Benson Gulch and in the others adjoining. In the former gulch the gold is the coarsest, there being many $10 to $50 nuggets. No quartz veins are found in the porphyry and slate in the vicinity of these gulches, and the source of the gold is quite problematical. The presence of the gold distributed sparingly in the conglomerates and more abundant in the gulches cutting them would indicate its derivation from the conglomerate. Strong currents must have been necessary to transport the huge granite bowlders so abundant at this point, but there are no definite traces of a river channel.

Summit Camp lies 8 miles E. of Goler. At the former point the sandstone caps the ridge (the eastern prolongation of the El Paso range), and is in turn nearly hidden by the more recent wash. The shallow gulches which head in this ridge generally carry gold though not always in workable quantities. It is said that prospects of gold can be found over much of the surface. This is the highest of the camps, having an elevation of 3,300 ft. Water has to be hauled many miles. Although hundreds of claims have been located, only a few are being worked, and those not always successfully.

The same formation appears in places for some miles east of the Summit Camp, but not much gold has been found.

Dry washers are used exclusively in these districts, but there are comparatively few places where the gold is abundant enough to make that method pay. If water can be introduced there is without doubt a great future for the districts.

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AURIFEROUS CONGLOMERATE IN CALIFORNIA.

By R. L. DUNN, M.E.

Three distinct classes of gold-bearing deposits, geologically considered, have been well known and mined in California. These are, first, the auriferous quartz veins, and most naturally classifying with them, the slates and other metamorphic rocks containing gold associated with pyritous minerals. These deposits are the primary matrix and original source of the gold found in the second and third classes. The second class is that of the Neocene (Pliocene and Miocene) river gravels, auriferous from the erosion of the gold-bearing quartz veins and auriferous metamorphic rocks of the first class. These gravels are found in the channels of the Neocene rivers which became obliterated and destroyed as drainage conduits in the latter part of the Tertiary period by the lava-flows and accompanying geological phenomena of that time. They are frequently referred to as the "buried rivers" or as the "ancient rivers" of California, and they constitute the hydraulic and drift mines, the principal source of the yield of placer gold at the present time. The third class comprises the placer deposits of the Quaternary and the recent erosion and formation of the beds, bars, and benches of existing stream channels, and generally speaking, the shallow surface placers. The source of the gold of this last class is in either or both of the preceding. Though some of these latest placer deposits are locally of some importance considered as a class with regard to the total gold yield of the State annually, they are now of little and diminishing consequence.

In the summer of 1892 the writer, reporting on the mines and mineral resources of Siskiyou County for the State Mineralogist, made a superficial examination of an auriferous deposit which appeared to have peculiarities that suggested the possibility of its being unique. (See our XIth Report, pp. 420, 448.) During the past summer, 1893, under the direction of the State Mineralogist, he has made a much more detailed examination and topographical survey of the deposit. Briefly stated, this later investigation established the surmised unique character of the deposit, though some of the qualified conclusions of the preceding examination were not verified. Considered with reference to the preceding classification of the California gold-bearing deposits, its place is between the class of the lodes and that of the Neocene gravels. Like the latter it is a gravel-filled stream channel, the accumulations of erosion; like the former it is a rock in place bearing gold. Its auriferous character has clearly resulted from the action of mechanical forces in the breaking out and re-concentration of the gold of older formations, as distinguished from the action of chemical forces in the distribution of gold in quartz, and associated with the pyritous minerals in the metamorphic rocks. Comprehensively, it is an auriferous gravel bed compacted by age and some metamorphism into a conglomerate. This conglomerated condition exists occasionally in the Neocene gravels, but is not charac-

teristic of them; when it does occur being more often the result of a cementing of the mass by the chemical changes of some of its constituents than a blending and coherence as a result of pressure and age. The distinctive and unique difference is, however, age rather than physical condition. It is a much older deposit than the auriferous Neocene gravels, being a Mesozoic formation—secondary in geological age as compared with the Neocene, which is Tertiary. In the order of the succession of the rocks it rests unconformably in an eroded depression in the metamorphic Mesozoic or Pre-Mesozoic rocks. It is directly overlaid by another Mesozoic formation, the Cretaceous (Chico) sandstone. In the writer's opinion the difference of geological age seems sufficient to support a distinctive name, as it is to be presumed that other deposits will be discovered, or identified among those already known. Requiring practically the same methods of mining and treatment to obtain the contained gold as the South African Transvaal conglomerate deposits, the name "Auriferous Conglomerate" is suggested. For the purpose of description the deposit will be so referred to in this paper.

The map accompanying it is compiled from the writer's special surveys of the deposit, the U. S. Public Land Survey, and the topographical sheet of the U. S. Geological Survey. As to the general details of the locality, it is self-explanatory.

GEOLOGICAL.

The richness in gold of the "Auriferous Conglomerates" where exposed by the Quaternary and recent erosion, gives to the geological conditions of its existence unusual interest, both as being in a measure determinative of the probable location and gold-bearing value of the vastly greater extent of the deposit buried, and as suggesting and directing exploration for similar deposits elsewhere in the State. Accentuating this specially local scientific interest and economic importance, is the fact that there are many geological phenomena connected with this deposit that associate it with the so-called "Reef" gold-bearing deposits of the Witwatersrand, near Johannesberg, in the Transvaal, South Africa.

There are in Northern California two distinct groups of rocks, or preferably stated the rocks of Northern California are divisible into two distinct groups. These are, first, the highly metamorphic and altered sedimentary, crystalline, and eruptive rocks; and second, the occasionally metamorphic, but ordinarily unaltered sedimentary and eruptive rocks and unconsolidated formations. The first described group comprise the older formations, and compose the mass of both the Sierra Nevada and Coast Range, and the floor on which rest the formations of the second group in the region between the ranges. The auriferous quartz veins and pyritic rocks all belong to the first group, and the placers are part of the second. The first group is indifferently designated as the "Metamorphic Series" or the "Auriferous Series," but there is no distinctive group name for the second group. Stratigraphically, the Metamorphic Series includes, doubtfully, some Archæan rocks, definitely the Carboniferous and probably other Palæozoic formations, and the Mesozoic, Triassic, and Jurassic. The other group includes the later Cretaceous of the Mesozoic period, the Tertiary, Pliocene, and Miocene (Neocene), Quaternary, and recent formations. In the orderly stratification of the rocks there is a clearly marked break between the two groups. The rocks and formations of the second group rest uncon-

formably on the Metamorphic Series at every point at which their contact has been observed and examined. This unconformability is conclusive geological evidence of a period of regional elevation above the sea subsequent to the formation under the sea of the older group of rocks and prior to the formation of the rocks of the younger group; also under the sea except as to the eruptives which may be deposited either on the land surface or under water, and further excepting the noted "Auriferous Conglomerate." The formation of this latter in place is, in the writer's opinion, assignable to the period of regional elevation, while the dynamical conditions that consolidated it into its present form existed during the subsequent period of regional subsidence below the sea when the Cretaceous strata were being formed. A period of regional elevation as a period of sub-aërial erosion, during which air, rain, and running water break up and carry back into the sea enormous quantities of the uplifted rock-masses to ultimately form of them other rocks. These eroding activities of air and water are observable and measurable at the present time everywhere on the land surface of the earth. Their energy in the Tertiary period is shown in the eroded river-channel depressions and their gravel-filled beds so extensively exposed by drift and hydraulic mining in the Sierra Nevada Mountains. The Siskiyou County deposit of "Auriferous Conglomerate" is the existing result of the action of the same forces in the early Cretaceous, the deposit certainly being the gravel-filled channel of a Mesozoic river. This, although its position under the Cretaceous (Chico) sandstone, adjacent to the shore-line of the Cretaceous sea, quite naturally has suggested that it might be a sea-beach-formed conglomerate and not accumulated river gravels in place. Such sea-beach or near-shore conglomerate deposits would be formed by the direct wave erosion of the solid rocks; by tidal and current distribution of originally river gravels which have been discharged by torrential streams into the sea at their mouths; and third, by the erosion and redistribution of the channel accumulations of submerged rivers, such a phenomenon, for example, as is now presented at Gold Bluffs on the coast of Northern California. The rocks of the Metamorphic Series on which the "Auriferous Conglomerate" rests unconformably form the northern portion of the main auriferous mineralized belt of Siskiyou County (see our XIth Report, p. 421), and are markedly auriferous in the immediate locality of the conglomerate. Gold-bearing quartz veins are numerous, and the rocks themselves are highly quartzose and mineralized with pyritic minerals. Still there are no workable veins known; only small seams and occasionally a rich pocket. The recent placers exclusively formed from their recent erosion are insignificant in extent, and have never been profitably mined. The wave erosion of these hard rocks, limited as such erosion would be to the cutting edge of the wave crest, and by the protection against even that cutting afforded by the accumulation of eroded fragments, cannot account for the enormous mass of the conglomerate. The linear extent of the latter is certainly 10 miles, possibly more than double that additional, its width where measurable about 1,500 ft., and thickness an average of 100 ft. The rocks are not sufficiently auriferous for their direct erosion to account for the relatively much greater auriferous value of the conglomerate, nor can wave energy account for the concentration of the gold at the bottom on and near the bedrock. The preceding stated conditions are equally conclusive against the possibility of the formation of the deposit by tidal and current dis-

tribution of the discharged gravels of torrential streams. In addition the topography of the section is such that the inference is against the existence of any such streams. It is, however, possible that the regional subsidence preceding the formation of the overlying Cretaceous sandstones for a period brought within the range of action of the sea waves the gravel-filled river channel. It is possible that some erosion of the upper portion of the original mass took place, but it is evident that the erosion did not extend to the bed of the old river and that the conglomerate is in fact the river gravels in place so far as sea erosion is concerned. A condition of regional subsidence in which the rate of sinking exceeded the rate of the erosion by the rising wave edge, explains the preservation in place of the old channel gravels. Precisely this phenomenon is presented by Gold Bluffs. There the ocean is cutting into the gravel- and sand-filled channel of the ancient Klamath River. But the drift accumulations now being cut away must have been made above the sea-level, necessarily inland, and probably during a period of local uplifting, which ultimately, by its obstruction to drainage, diverted the river into its present channel. As a consequence of subsequent regional subsidence (continuing down to the present time, if indeed it is not now going on), this ancient river channel is disappearing beneath the sea at a rate which has prevented its complete obliteration by wave erosion. The latter is only cutting away and redistributing the upper portions of the old debris-filled channel. The bed, and likely several hundred feet depth of sands and gravels, are sinking beneath the sea surface undisturbed by its waves.

The fluviatile origin of the conglomerate deposit is further established by its appearance in sections afforded by the existing stream cuts and by mining excavation. On the map is shown a cross-section of the "Auriferous Conglomerate" and associate formations made by the Klamath River. It distinctly shows the bedrock bottom and limiting rims of the old channel. The Tertiary and Quaternary uplift (probably the latter, as the tilting seems to extend to the capping Tertiary lava) has tilted the Cretaceous beds so that though originally deposited approximately level they now have a mean dip of 17°, in direction about N. 55° E. Restoring the section by eliminating the dip of 17°, the bedrock under the middle of the deposit of conglomerate becomes level for a distance, as determined, of about 800 ft. This would then be the width of the bed of the old channel at this particular point. The southwest rim, in the section as existing rising with 24° of slope from level, in the restored section rises with only 7° of slope from the bed of the old river. The northeast rim, in the existing section appearing nearly level, in the restored section rises with 17° of slope from the bed of the old river channel. This northeast rim limits the downward extension of the "Auriferous Conglomerate." Farther to the northeast the sandstone rests directly on the metamorphic rocks, the contact disappearing under the Klamath River. Correspondingly the upward extent of the conglomerate is limited to the southwest rim. Beyond it the sandstone rests directly on the metamorphic rocks. Not shown on the Klamath section, this appears in plan on the main map.

The tributaries of Cottonwood Creek do not cut through the conglomerate, but the partial sections made by their erosion show the distinctive individual slopes of southwest rim and channel bed.

The principal section afforded by mining excavation is the bank face

in the hydraulic pit of the Blue Gravel Mine on the right bank of Klamath River. Its appearance is similar to the sectional exposures of gravel banks in the hydraulic mines in the Neocene river deposits. As far down as the action of the atmosphere and surface water extended the color of the deposit is red, and it is more or less decomposed. The balance of the deposit is dark blue in color, suggesting the name "blue gravel." The conglomerate is composed of water-worn rounded pebbles, cobbles, and large bowlders, derived from the metamorphic and crystalline rocks, quartz, granite porphyry, limestone, and diabase, the latter the immediately underlying bedrock. The cementing material consists of sands and clays, the finer fragments and sediments of the same rocks. Streaks and beds of sandstone and a soft red rock appear in the body of the conglomerate, corresponding to the sand and pipe-clay streaks of the Neocene gravels. Other constituent parts of the conglomerate in small quantities are gold, magnetite, hematite, pyrite, chalcopyrite(?), garnet, ruby, and sapphire, all (except the gold and hematite) in small water-worn grains. Some of the hematite appears in pseudomorph crystals apparently after calcite. The gold is generally of the description known as channel gold, occurring in nuggets, coarse and fine grains, scales, and flour gold. Its distribution is similar to the observed distribution of the gold in the gravels of the Neocene and existing streams. It is largely concentrated near the bedrock, on and even in it, in pay streaks or leads. These seem to follow the longitudinal direction of the channel.

The irregular, meandering line of the old channel adjacent to Klamath River is displaced by the tilting of its plane, and subsequent erosion has left it in relief, so far as some of the adjacent region is relatively situated. The continuity of the conglomerate deposit is inferable through this section from the exposures which are numerous and not widely separated. Its location is determinable with a fair approximation to accuracy from these same erosion exposures. Northward from the Klamath a distance of 5 miles, it is so located and delineated on the map. Southward 7 miles it is indicated, but with a less degree of exactness toward the southern end, as the conglomerate exposures are less conclusive. Both northward and southward from the determined section the displacement has left the old channel deeply buried. Excepting an exposure of the conglomerate for a distance of about a mile near Yreka, there is no surface indication from which the buried portion of the old channel can be located.

The data on which is based the conclusion of the writer, that the conglomerate is an old river channel deposit, has been here presented in considerable detail by reason of its particular pertinence to the occurrence of the gold. If the conglomerate were a beach deposit formed from direct erosion, its gold-bearing character would be limited and local to points adjacent to where auriferous quartz veins were cut down and broken up, and there could be no presumption of gold-bearing value as an incident of the linear extent of the deposit. On the other hand, the certainty that the conglomerate is an old river bed accumulation in place, establishes a presumption of average gold content per unit of weight, volume, or bedrock area, for the buried and uneroded portion of the conglomerate, equal to the average gold content per corresponding unit of the naturally eroded or mined portion; that is, the

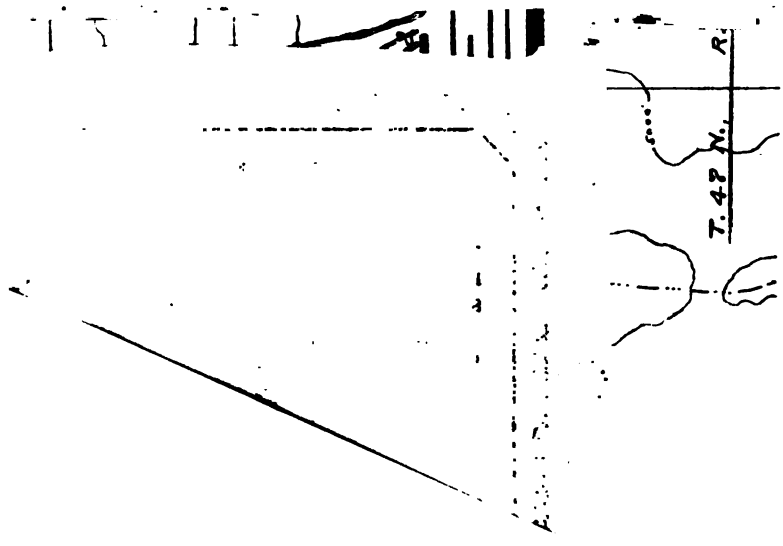
conditions of gold distribution and gold content per unit are precisely those of the Neocene river gravels, and may be similarly estimated.

The direction of the flow of the old river was most probably southward, the writer's opinion being based on its location with reference to the Coast and Sierra Nevada ranges, and on the assumption of the Mesozoic regional elevation during which the river existed, being the resultant of geological activities, the recurrence of which has produced the present relief of the region. Also cumulative of this, the exposed area of the rocks of the Metamorphic Series adjacent to the conglomerate does not seem sufficiently extended and auriferous to account for the gold accumulation in the conglomerate. Yet it is from this area that all the gold must have come if the flow of the old river was northward. There is no other possible source for it on the assumption of a northward flow. With a southerly flow, however, the old river had the erosion of the indefinite northward extent of the main mineralized belt of Northern California, which is now buried underneath the Cretaceous and later formations, from which to concentrate gold.

The geological phenomena that associate this California "Auriferous Conglomerate" with the so-called "Reef" (conglomerate) deposits of the Witwatersrand, Transvaal, in South Africa, are particularly connected with the overlying Cretaceous strata, and not with the conglomerate itself. These strata consist of sandstones mainly, but stratified conformably in their mass are shales (locally termed "mud slates") and seams of conglomerate similar in composition and appearance to the main underlying bed. The shales are also associated with a greater or less development of lignite in seams and beds; at one point, designated on the map, three miles southwest of Ager, a vein 3 ft. thick is being mined. Excepting the lignite, the structural formation of the "Reef" deposits is identical. The South African formation is, however, much the older, being carboniferous, and metamorphism has altered the sandstone into quartzite, the shale into a schist, and has tilted and faulted the strata. The conglomerate is identical in appearance with the South African. No examination has been made to determine if they are equally auriferous. It is suggested that a more thorough study of the Siskiyou County formation and the phenomena presented at Gold Bluffs may tend to solve the problem of the occurrence of the gold in the South African conglomerate.

TOPOGRAPHICAL.

The drainage of the region of the "Auriferous Conglomerate" is through Klamath River and some of its tributaries. The surface of the country west of the deposit is broken and mountainous. North of Klamath River, Cottonwood Creek has made two narrow valleys, the lower one just east of the deposit. South of Klamath River the middle drainage basins of Shasta River and Willow Creek merge into each other and together form Shasta Valley. Between the valley and the river is Black Butte, a lava-capped mountain 5,270 ft. high. The conglomerate deposit is close to the western rim of Shasta Valley, as far as traced, and it passes beneath the southern and western edges of Black Butte. The mean elevation of Cottonwood Valley is 2,200 ft., and of the portion of Shasta Valley adjacent to the conglomerate deposit about 2,700 ft. The



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tter, north of Klamath River, is between 2,100 and 2,800 ft., and south it between 2,100 and 3,500 ft. in altitude.

The Klamath River in this locality is a large torrential stream. Flowg southwesterly it crosses the contact of the Metamorphic Series and ıe Cretaceous sandstone nearly at right angles. The section across the ›nglomerate has already been described. Longitudinal exposures of the ›nglomerate have been made on both sides of the river by small tributries. On the northern side Rancheria Gulch is a small depression, :arcely a mile in length. Its bed follows closely the existing line of ›ntact of the formations, and to its erosion is clearly due the existing djacent portion of this contact line. Adjacent to the river it has eroded s channel diagonally across the old river channel bed, cutting away nd carrying off into the Klamath River a considerable area of the conlomerate. Its particular interest is in its shallow placers, which, hough limited in area, were extremely rich, and unquestionably deived their gold from the erosion of the conglomerate. On the south ide of the river Carson Gulch has exposed the edge of the conglomerate eposit for a considerable distance, but apparently has not cut as deeply nto it as Rancheria Gulch. The gold of its placers seems to have come lmost entirely from the erosion of small auriferous quartz ledges in the ıard metamorphic rocks. These placers were noticeably not as rich as hose of Rancheria Gulch.

The lower Cottonwood Valley is the most interesting topographical eature of the district. Cottonwood Creek, flowing through it, is a large ıtream which rises in the Siskiyou Mountains in Oregon, and with ıumerous small tributaries drains a large area of country lying partly n both States. The valley is clearly the result of the erosion of the :reek in the comparatively soft sandstones and shales lying between the ıard metamorphic rocks and the equally hard lava. More particularly, t is the cumulative effect of a number of channels successively eroded oy the same stream at different periods in its history, the process of its ıction being that described in our XIth Report (Siskiyou County) as he cause of bar and bench formations on the Klamath River, namely, the greater rate of channel-bed cutting of a running stream in soft rocks ıs compared with hard rocks. The first drainage channel of Cottonwood Creek probably formed on the contact of the lava and the metamorphic rocks subsequent to the Quaternary tilting, and ultimately cut below the lava into the softer sandstones and shales. In these the rate of cutting was much more rapid than that of the Klamath River in the hard metamorphic rocks below the junction of the two streams, until a base level determined by the Klamath erosion was approximated. The creek then losing its carrying power through diminished velocity of flow, ceased cutting and commenced accumulating sands and gravels, raising the bed of the water flow until the obstruction to drainage diverted it into a new line of depression, to be by it eroded into a second channel. In turn the second channel, and successive channels subsequently, went through the same process of formation and obliteration, each working its cut a little deeper than the immediately preceding one, and a little farther to the northeast—the greater depth to bring it to the new base level of the Klamath determined by its erosion between the periods of two successive channel formations, and the northeastward tendency caused by the relatively larger quantities of debris brought in by the tributaries from the southwest, which, accumulating, maintained that side

of the channel higher than the other, which then became the depressio for the water flow and erosion. Extensive remains of the detrita accumulations of one of the first of these channels, if not indeed th first, exist in a range of low hills lying on the base of the mountains o the southwestern edge of the valley. They are composed of clean-wash and water-worn gravels and cobbles, and a soft, sandy clay. The roc is so largely quartz that the deposit is locally known as the crystalline wash. Between the remains of this old channel and the present chan nel of the creek, there are the fragmentary eroded depressions and dri accumulations of the several channels of the intervening period, an also the remains of one or more old channels of each of the tributaries, the latter making cross erosions. All of these channels are merged an obliterated more or less, one by the other, and by the present channe of the tributaries, so as to be indeterminate as to individuality. It is however, their cumulative effects which are significant and most appre ciable, namely, the formation of the valley, and the accumulation an concentration in it in shallow placers of an enormous quantity of gol

ECONOMICAL.

In 1852 the shallow placers of the Cottonwood Valley were discov ered. Limited in extent to a district not over 3 miles long by 1½ wid they have yielded in the forty-two years elapsing since the date of the discovery an immense amount of gold. Nearly all of the mining wa done in the "fifties" by individual miners or small companies, usi only the simplest appliances—pan, rocker, and sluice. Anything mor than an approximate to the aggregate value of the gold taken out sin their discovery can never be known. The best informed of the ol residents estimate that $4,000,000 has been taken out, including in th the yield of Rancheria Gulch. The basis of their estimate is the num ber of miners engaged in the several years and the daily gold yield t each miner. The town of Cottonwood, now Henley, built and su ported entirely by these mines, at one time in the early "fifties" had voting population of 700, and a Chinese population of 500. In 185 one of the storekeepers is said to have sent a mule load of gold ever week to Yreka, the supply point for the district. One of the claims, th Brass Wire, in Rocky Gulch, is known to have yielded over $250,0 As a whole the placers were considered rich, even for early days, an quite generally are said to have paid miners more than the then rulin rate of day wages. Confirming this reputed richness, the occasion discovery and working of small areas overlooked by the old miners covered by their tailings piles, pays the miners from $6 to $20 a day.

Almost exclusively all of the mining has been in the fragments remains of the old channels lying in the valley between the chan known as the crystalline wash and the present channel, and in th channels of several of the tributaries. No gold has been found in th crystalline wash, and the present bed of the creek was not especia productive. Rancheria Gulch contained a small area of exceeding rich placers, and became the site of a small mining hamlet for seve years. The largest nugget found in the district came from these placer It was valued at $1,900.

The situation of Rancheria Gulch with reference to the "Auriferou Conglomerate," the absence of quartz veins within its drainage ar

sufficiently numerous and rich to have been the source of the gold found in its placers, the identity of the gold found in the placers with gold found since in the adjacent conglomerate, are conclusive in establishing the "Auriferous Conglomerate" as the source of the gold of the shallow placers to which reference has been made. As a physical necessity resulting from the occurrence of the gold in Cottonwood Valley in placers demonstrably formed by existing streams, the source of the gold, so far as those placers determine it, is within the drainage area of Cottonwood Creek as it now exists. East of Cottonwood Creek no trace of gold has ever been found. West of it, above what is designated on the map as "Cañon," being the channel of the creek in the hard metamorphic rocks, only the deposits at Soda Bar and in the West Branch contained any gold. These placers are limited in extent and have never been particularly rich. The source of their gold is clearly determinable as being in the small quartz veins in the upper portions of the drainage area of the West Branch. The tributaries of Cottonwood Creek, Kanaka Gulch (now discharging directly into the Klamath, but at an earlier period in its history into the creek), Rocky Gulch, Rancheria Creek, and Ditch Creek, all contained placer deposits and all have been mined. From the placers in the main valley up to where the "Auriferous Conglomerate" is cut through, these placers have been uniformly rich. Above the conglomerate, except in Rocky Gulch, they cannot be mined profitably, and are very limited in extent. Noticeably the gold obtained from them is different in description and fineness from the gold of the lower placers. It is, as a rule, little washed, and undoubtedly derived directly from the small auriferous quartz veins of the metamorphic rocks. The auriferous character of the conglomerate, determined directly from mining it, makes conclusive the evidence establishing it to be the immediate source of the gold of the Cottonwood Valley placers.

Klamath River, receiving the erosion of Cottonwood Creek as well as its own direct erosion, derived from the "Auriferous Conglomerate" a very large amount of gold. No gold at all is found in its bed, bench, or bar formations above the junction of Cottonwood Creek. Nugget and coarse gold has only been found in the section of the river from Cottonwood Creek downward to about Honolulu. Above this last noted place there is only one area, other than the conglomerate section, which has contributed any large amount of gold to the river. This is the drainage basin of Humbug Creek discharging into the river 2 miles above Honolulu and 15 miles below Cottonwood Creek. At Honolulu, the writer is informed, pieces of the conglomerate are found in the river mines containing gold, also coarse gold that probably came from it. Above Humbug Creek it is probable that by far the largest portion of the gold in the river bed was derived from the conglomerate. How much has been mined from this section of the river is not known. So far as known, river mining in this section has been profitable. It has been as extensively carried on as in any other portion of the river, employing as many companies and men, and as continuously. The total of yield in the forty years of its mining can be certainly estimated in the millions.

The contacts of the conglomerate and bedrock where exposed by erosion have been determined and surveyed. From them the superficial areas of erosion of the old channel bed and rims have been computed

with a fair approximation to accuracy. The figures so determined are as follows:

For Klamath River	3,500,000 sq. ft.
Rancheria Gulch	1,000,000 sq. ft.
Kanaka Gulch	100,000 sq. ft.
Rocky Gulch	200,000 sq. ft.
Rancheria Creek	700,000 sq. ft.
Ditch Creek	400,000 sq. ft.
Bushy Gulch	200,000 sq. ft.
Total	6,100,000 sq. ft.
Or excluding Klamath River, the total is	2,600,000 sq. ft.

This last total being the superficial area of the old channel, the erosion of which has directly contributed to the formation of the Rancheria Gulch and Cottonwood Valley placers. Considerable of the gold of this area has undoubtedly been carried into Klamath River, and another large amount is still in unworked shallow placers. The sum of these two amounts is assumed to be at least an equal offset for the gold that has been mined in these shallow placers, the source of which, could it be known, would be in the metamorphic rocks above the conglomerate. The total yield of these placers being estimated at $4,000,000, and the area of eroded conglomerate being 2,600,000 sq. ft., the yield has been at the rate of $1 54 per square foot for both channel bed and channel rim areas.

The Cottonwood Valley and Rancheria Gulch placers were the result of nature's hydraulic mining, or rather ground-sluicing, on an enormous scale, with time limits marked by the geological ages. Into them was concentrated gold, which in the conglomerate was distributed throughout its entire mass. There is no mining method by which it is possible to economically effect the same result; that is, to obtain by mining methods and appliances all of the gold in the conglomerate. In this the deposit is like some of the Neocene river gravels containing gold distributed throughout their entire mass, but which are either covered with too great accumulations of barren formations, or have not the necessary amount of dump for working on a large scale. Like these same Neocene gravels, the economic value of the deposit is restricted to the gold content of that portion of the mass in which it is most largely concentrated; this is the 4 or 5 ft. in depth of the conglomerate resting directly on the bedrock of the old channel bed, and including the softer superficial portions of the bedrock itself in which some of the gold is imbedded. In the Blue Gravel Mine a sufficient area of this channel bedrock has been worked for its yield to provide a safe basis for estimates of the gold content of the unbroken ground in the channel, and of the economic value of the entire deposit. This mine was discovered in 1887 by a Mr. C. B. Jillson, whose experience was obtained in the hydraulic and drift mines in the Neocene gravels in Sierra County. Prior to this discovery the auriferous character of the conglomerate does not seem to have been suspected. Proceeding on his former experience, and thus very naturally misconceiving the real character of the deposit, Mr. Jillson opened the mine and attempted to work it by hydraulicking, bringing in a supply of water from Ditch Creek for that purpose. At the date of the writer's examination 31,000 sq. ft. of the bedrock had been completely stripped and had yielded in round numbers $20,000, an average of 60.6 cents per square foot. It is, however, known that a large amount of gold was swept into the dump, the Klamath River, in unbroken masses

onglomerate, and that there was a further loss of gold in sulphurets. n additional area of hydraulic stripping was done, but the bottom onglomerate left. This at the time of examination was being taken up y hand and worked in an arrastra. This working, though by no means horough, as the conglomerate masses were not pulverized, returned a arger unit yield for the bedrock stratum than the hydraulicking did or an average depth of 20 ft. washed. The yield for 420 tons worked as $1,489, an average of $3 52 per ton, or 88 cents per square foot of edrock area. With proper appliances and methods, thorough pulverization, and the concentration and working of the sulphurets, the yield would safely have been $1 a ton, or 25 cents more per square foot. The rrastra tailings contained about 1 per cent of concentratable magnetite and pyrite, which assayed $101 per ton.

From the slope of the Black Jack Mine 100 tons of the conglomerate were worked in a stamp mill, returning $275, or at the rate of $2 75 a on. It is known that all the gold was not returned, the milling not being thorough, and much fine gold being lost in the tailings. An assay of concentrates from this mine is said to show $590 to the ton. No letermination was made of the percentage of concentrates, however.

At the Charter Oak Mine, in Ditch Creek, the tunnel had only cut hrough the rim into the conglomerate. Prospecting showed some fine gold and concentrates which assayed $120 a ton.

In the writer's opinion, the development of the Blue Gravel Mine is sufficient to make its figures of unit gold-content of actual return and safe estimate of avoidable loss, a basis of estimates. These figures are: actual return, $3 52 a ton, or 88 cents per square foot, and avoidable loss estimated $1 a ton, or 25 cents per square foot. The total of the two is $4 52 a ton, or $1 13 per square foot of bedrock area. To further assure safety of the estimate of available gold content of the entire deposit, these figures are reduced to $4 a ton, or $1 per square foot. Assuming a channel-bed width of 800 ft., as indicated by the survey of the Klamath section, the economically available gold content of the portion of the channel that can be located north of Klamath River is $21,000,000, and of the section south of the Klamath $22,000,000; in all a total estimate of $42,000,000.

In stating $1 as the writer's estimate of economically available gold content per square foot it is not to be inferred that each and every square foot of the channel bed contains an approximation to that amount of gold. As a practical fact, large areas likely contain no gold at all, their proportion being concentrated in pay leads or areas of higher unit yield. Further, much of the gold is coarse, nuggets ranging in value from $10 upward forming much of the total value of the deposit.

The conditions of existence of the gold necessitate drift mining as the method of exploitation of the conglomerate. For this the topography is specially favorable. Nearly the entire extent of the located channel is above the drainage level of Klamath River. The mining can be through tunnels, and the conglomerate is so compact as not to necessitate timbering the mining excavations other than may be required to facilitate working. Ventilation is possible by natural draughts. The conglomerate works well with powder. Power drills and traction can be economically used. An abundance of water power is available by electric transmission from Klamath and Shasta rivers and Cottonwood Creek. Economy of construction and maintenance of the necessary

mining and milling plants is assured by the near location of sawmills, direct railroad transportation to the centers of trade and population, and an adjacent agricultural country in Shasta Valley and Southern Oregon.

It is not to be lost sight of, however, that the deposit is distinctly a low-grade proposition. Its profitable working is only safely assured by operation on a very large scale with large plants, making every possible economy. Under the suggested favoring conditions of operation the cost of mining and milling should not exceed $1 50 a ton, or 37½ cents per square foot of area.

Since the preceding was written the writer has had an opportunity to examine some other Cretaceous and Pre-Cretaceous auriferous placer deposits. The Chico beds, sandstones and shales, which overlie the "Auriferous Conglomerate" in Siskiyou County, extend far southward into Shasta County, in California, and far northward into Oregon. Four miles southwest of Redding, in Shasta County, the Chico sandstone is found resting unconformably on the metamorphic Pre-Cretaceous rocks precisely as it does in northern Siskiyou County. In what is locally known as Oregon Gulch, close to the contact of the sandstone and metamorphic rocks, a shaft was sunk through 40 ft. of sandstone to the metamorphic rock (slate) which dipped eastward on about the same pitch as the bedding of the sandstone. Following the contact downward on the pitch the shaft opened up a small bed of auriferous gravel lying in a depression of the slate underneath the sandstone. This gravel bed where cut was 2 ft. deep in the middle and about 40 ft. across. Singularly enough, it was neither cemented nor conglomerated, though it contained considerable amounts of oxide of iron, and must have been subjected to enormous pressure from the mass of consolidated sediments overlying it. The gravel is smooth and stream-washed, but contains marine shells too much broken to be identified. The gold is very fine, and is found in the fine pyritic matter. On a smaller scale, the deposit is a copy of the Siskiyou deposit. It probably belonged to the tributary system of the larger channel. In this connection it is noteworthy that Mr. J. S. Diller, of the U. S. Geological Survey, has found the fragmentary remains of Cretaceous stream channels a few miles still farther to the southwest of Redding.

Just across the State line in Jackson County, Oregon, is the valley of Bear Creek, a tributary of Rogue River. The contact of the sandstone and granite traced northward from the State line after crossing the summit of the Siskiyou Mountains close to the railroad tunnel, crosses the head of Bear Valley east of the railroad, then turning more northwesterly recrosses the valley just north of the town of Ashland, and thence runs through the foothills flanking the valley between Ashland and Jacksonville, and comes out into the valley again just east of Jacksonville. The valley itself between these places is eroded out of the sandstones, but the erosion at no place exposes the conglomerate seen in California at Henley. However, on the hill slopes between Ashland and Jacksonville are exposed some very much decomposed conglomerates bedded in the sandstone. Whether one bed or several of this conglomerate exist, the exploration made is not sufficient to determine, but the conglomerate wherever exposed is auriferous. In superficial appearance the conglomerate is an ocherous-looking decomposed rock. On

closer examination it is found to contain considerable quartz, a portion of it distinctly water-worn and rounded. The other prominent constituents are feldspar and mica. It is evidently the resultant of the erosion of the adjacent granite. The gold is very fine, free in large part, but blackened and coated. Associated with the gold are found magnesite, pyrite, cinnabar, natural amalgam, and free quicksilver. What is known as the Golden Fleece Mine is located on this deposit, near Ashland. A pit has been excavated in the bed and some short drifts run, following the conglomerate into the hill. The bed rises with the hill slope, but at a less angle. On the mine is a 3 ft. Huntington mill, in which several runs have been made of the conglomerate, with more or less satisfactory results. Yields of from $1 to $5 a ton have been obtained in free gold. The concentrates are very high grade, containing gold too much coated to amalgamate, as well as that mechanically held by the sulphurets. The methods employed, it seems to the writer, can be considerably improved. Mining and crushing can be done very economically, but more effective appliances are needed for obtaining the gold that does not amalgamate either in the battery or on the plates.

The occurrence of gold in sufficient quantity in this Ashland conglomerate to admit of its economical extraction is suggestive of similar possibilities in conglomerates bedded with the sandstones and shales in the vicinity of Henley, in Siskiyou County. The Cretaceous sandstones that overlie the auriferous conglomerate, the old river channel deposit, in addition to beds of shale and occasional seams of coal, contain several conglomerate beds exposed by the ravine erosions. These have never been mined nor tested to ascertain whether or not they contain gold. Their exploration is, however, expedient under existing conditions of our knowledge of gold-bearing deposits.

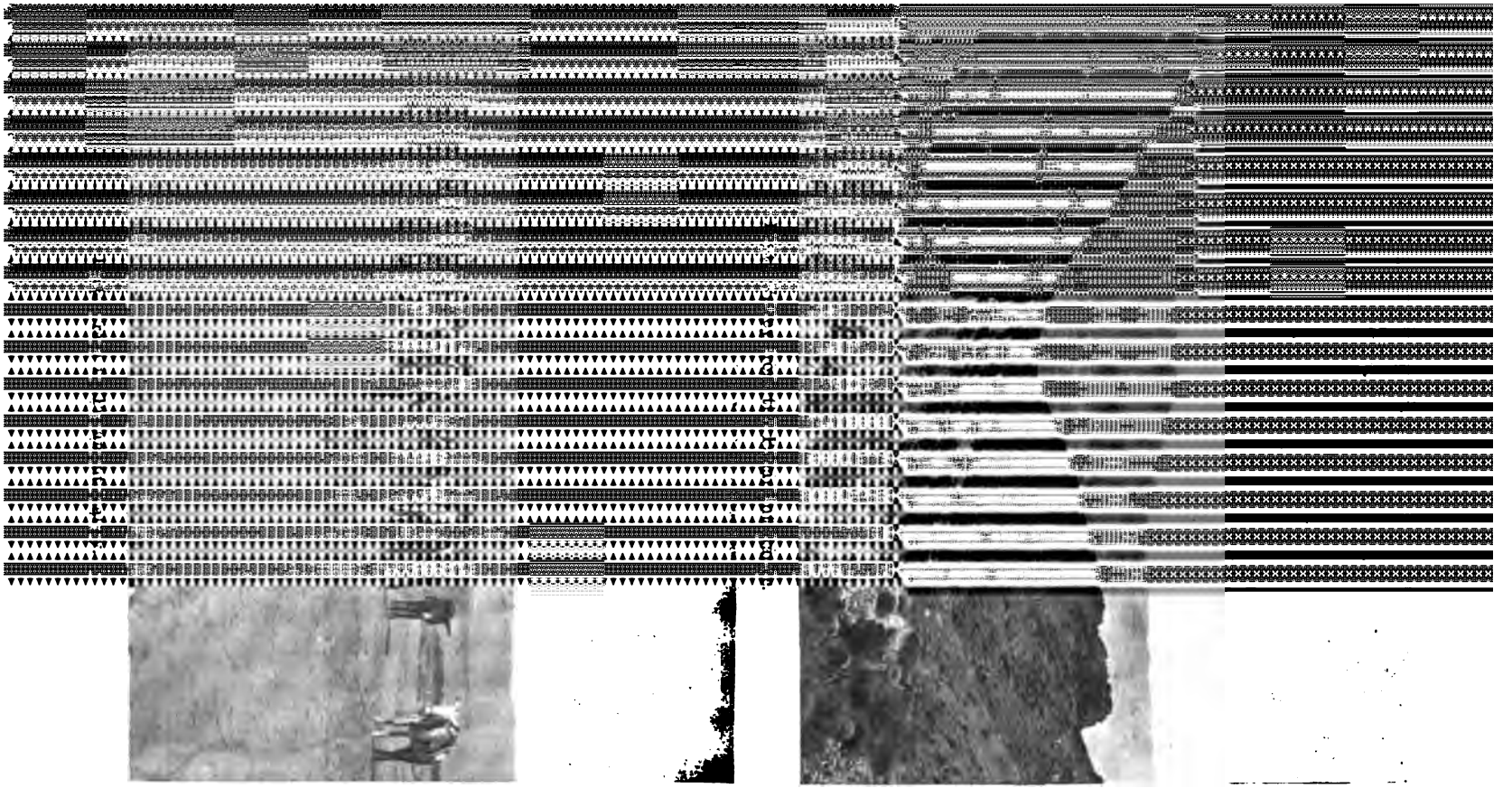
In conclusion, the writer desires to express his obligations to Professors Joseph LeConte, Christy, and Lawson, of the University of California; Prof. Brander, of the Leland Stanford Jr. University; Mr. Jas. E. Mills, Mr. Waldemar Lindgren, Mr. Ross E. Browne, and Mr. J. S. Diller, for assistance and friendly criticism given him during the preparation of this paper.

PRELIMINARY REPORT ON THE MINERAL DEPOSITS OF INYO, MONO, AND ALPINE COUNTIES.

By HAROLD W. FAIRBANKS.

Introduction.—That portion of California lying east of the Sierra Nevada Mountains, and extending from northern San Bernardino County to Alpine County, was examined by the writer, assisted by Mr. R. P. Heagan, during the season of 1894. The trip occupied the months of April, May, June, and July, but owing to the great extent of country and the exceedingly barren and rugged nature of portions of it, little more than a reconnoissance report on the mineral deposits can be made, with the exposition of some general principles of the structure of the country. It was found that in order to gain an understanding of the character and value of the mineral deposits a much more thorough geological examination would have to be made.

Topography.—The whole of the region examined lies within the Great Basin area, and in many respects, in regard to climate and physical features, as well as in its mineral deposits, it is much more like Nevada than California. On the west, the Sierra Nevada, with its almost precipitous scarp, rises 6,000 to 9,000 ft. from the valleys at its base. As we go eastward the region is seen to be traversed by a series of northwest and southeast ranges, in a general way parallel with the Sierra Nevada; and between these a series of desert valleys, becoming lower toward the east. Salt Wells and Owens valleys lie on the west directly at the base of the Sierra. The former has an elevation of about 3,000 ft., the latter an average elevation of a little over 4,000 ft. East of the Argus range is Panamint Valley, portions of which are not over 1,200 ft. above sea-level, while between the Panamint and Amaragosa ranges is Death Valley, below the sea-level. The U. S. Geological Survey has determined that one point in Death Valley is 480 ft. below the level of the sea—the greatest natural depression in the United States. The Inyo and White Mountain ranges rise to an elevation of 9,000 to 13,000 ft., while the Panamint reaches 10,000 ft. The larger valleys have all been occupied at some very remote period by alkali lakes, of which Owens and Mono lakes are the only ones of any size still remaining. As the valleys decrease in elevation to the south and east they become more arid, and finally blend into the great stretches of the Mojave Desert. Salt Wells Valley, lying mostly in northern Kern County, has the greatest extent from east to west, nearly 20 miles in places. It is separated from Owens Valley by an elevation so slight that it is proposed to introduce a great irrigating ditch from Owens River. This ditch commences 12 miles above Independence, some miles being partly constructed. The survey carries it around the west side of Owens Lake, and through the pass at Little Lake to Indian Wells. The length of the ditch is to be 110 miles, with a width of 35 ft. at the bottom and a depth of 6 ft. It is being built by the California Waterworks and



Irrigation Company, of London. Owens Valley has a length of fully 75 miles, and a width in places of 10 miles. It contains the largest part of the agricultural population of this part of California.

Geology.—The most important geological reports on this region have been upon the quaternary Lake Mono, by Israel Russel; on the general geology of Inyo and Mono counties, by W. A. Goodyear and others of the old State Geological Survey.

Save for the presence of lacustrine beds of late Tertiary or Quaternary age, and recent lava-flows, the younger geological formations are wholly absent from the eastern side of the Sierra. The eastern side of this range in Inyo County is formed wholly of granite; in Mono County there are large areas of metamorphic rocks.

The numerous ranges to the east might be described in a general way as consisting of an immense thickness of limestone, quartzite, slate, mica schist, etc.; the whole intruded by granite and raised in immense anticlinal or monoclinal folds. The granite areas are not confined to the axes of the ranges, but occur in the most irregular manner.

A brief description of the different ranges will be given, commencing in southern Inyo County. The Argus range begins on the southern border of the county as a low range of granite. Northwest of Borax Lake the mountains become much more prominent, and appear to consist wholly of granite as far as Shepard's Cañon. A little north of this point the granite passes to the west, forming the Coso range, which extends north to Owens Lake. A little north of Snow's Cañon, along the road to the Modock Mines from Darwin, limestone, slate, and quartzite are seen to have almost replaced the granite in the Argus range. North of Darwin this range again sinks, finally blending into the Inyo range. The Panamint range extends for a distance of 60 or more miles, and is in its higher portion the most prominent landmark of the desert. Limestone, quartzite, slate, and mica schist form the predominating rocks. Areas of granite are, however, found in places. Toward the north a spur of this range, known as the Pinto or Calico range, connects with the Inyo range. In the former range there is exposed a great thickness of beautifully variegated and banded limestones facing the west and visible for a long distance. Near Cerro Gordo but little granite appears in the Inyo range, and that is confined to the eastern slope. Farther north, in the Beveridge District, there are large bodies of granite uplifting the limestone in the center of the range and throwing it back in folds on the slopes. The granite forms the central portion of the range for a number of miles. Areas of this rock of considerable size appear in places in the White Mountain range, farther north.

Volcanic flows are very numerous over much of the western part of Inyo County. They consist mostly of basalt, and are very similar in appearance. Volcanic action seems to have been most severe in the Coso Mountains. The flows are not apparently all of one age. North of Owens Valley, between Bishop Creek and Mono Lake, there are extensive areas of volcanic tufas of various kinds, hornblende andesite predominating. These reach the summit of the Sierra Nevada between the heads of Kern and Owens rivers. The region about Mono Lake has been the scene of recent flows of basic as well as acidic lavas. North of the lake there is a great area of hornblende andesite, extending with local interruptions north to the summit of the Sierra, in Alpine County, and for an unknown distance into Nevada. The andesitic flows evidently took place prior to

the last great uplift of the Sierra Nevada. The region east of this range has been subject to many and violent disturbances, accompanied by lava-flows, some so long ago that profound modifications of the surface have since taken place, others so recent as to have undergone but slight erosion.

Mineral Deposits.—The following minerals are known to occur in the region under discussion: Gold, silver, lead, antimony, copper, iron, soda, and borax; besides excellent marble, travertine, and granite. Of these the most important are gold and silver. The silver output has in years past been the largest in Inyo County, while Mono County is more particularly characterized by gold. No statement of general application can be made as to the distribution of gold and silver or to the relation of either to any particular formation. It seems, however, that the silver-lead deposits are generally found in the limestone, which covers so much of this region, and the gold less often. There are notable exceptions to this rule, as at Benton, Mono County, and in the White Mountain and Panamint ranges.

A brief description of the different mineral deposits will be given, beginning with gold.

The Argus district, in the southern portion of Inyo County, embraces a granite region. The quartz veins which are being opened here contain silver and gold in varying proportions; the gold is, however, generally in excess. So little work has been done that the extent and value of the ledges have not yet been demonstrated. The gold is found free on the surface, but from the honeycombed character of the quartz, and the occasional presence of chalcopyrite and iron pyrites it is believed that at no great depth the most of the gold is contained in them. The silver is contained partly in copper glance, little or no lead ores occurring. The veins have no regularity of position, nor do they bear any relation to the numerous porphyry dikes intersecting the granite of this region.

Farther north, in Mountain Spring Cañon, there are small veins of gold-bearing quartz in a granitic rock, the gold being partly free milling and partly contained in iron pyrites.

On the eastern side of the Argus range, a little south of Shepard's Cañon, small silver deposits begin to appear, and are traced northward toward Modock and Darwin. In Snow's Cañon, near the northern termination of the granite of the Argus range, occurs a group of quartz veins, which, though generally small, are quite rich in gold, and also have a small content of silver. The richest portions of the quartz are much honeycombed, a character evidently resulting from the decay of pyrites. Those veins nearer the limestone contact are richer in silver.

The next deposits of gold northward are found in the Coso range, southwest and west of Darwin. The country rock is a coarse, easily decomposed granite. The veins have been worked to a depth of several hundred feet and are said to maintain their strength, but work was finally abandoned, because with greater depth more of the gold was found to be contained in iron and copper pyrites, and with the crude means at disposal could not be profitably worked.

The Panamint range is characterized chiefly by silver deposits. There are, however, some of gold in the southern portion. Near Post Office Cañon several veins of quartz are found, rich in gold (free milling on the surface) and inclosed in limestone. Ten miles south other deposits

have been discovered, but no development work of any consequence has yet been done.

About Cerro Gordo no ores but those of silver and lead are found. A few miles north, in the Beveridge District, on the eastern slope, where the limestone has been shoved aside and uplifted by a great granite mass, are found many gold-bearing quartz veins. In the most southern mines of this district gold and galena are associated together. With few exceptions the veins lie rather flat and at some distance up the sides of the very deep and rugged cañons. The deepest mine is the Keynote, which has been opened 700 ft. on the incline. The ores from the mines of this district are free milling on the surface, but with depth there is an increase of copper and iron pyrites. Those portions of the veins carrying copper are said to be richer in gold. Some of the veins are very regular and well defined, while others are pockety. The influence of the wall on mineral deposition is shown in a vein in Robles Cañon, where the gold content is replaced by silver on the passage from granite to limestone.

In the Alabama Hills, 5 miles north of Lone Pine, there are several small veins near the contact of granite and porphyry. The gold is in part free milling and in part contained in iron and copper pyrites.

At the western base of the Inyo range, and southeast of Independence, is a group of mines, the most of them occurring in limestone. Although gold is the most important mineral found here, there is in some places a large amount of argentiferous galena.

In the same range, and about half way between Independence and Big Pine, is a prominent vein traceable for a mile in the granite. The ore here is in part free milling and part sulphurets.

The Fish Springs District is situated on the western side of Owens Valley, between Independence and Big Pine. The gold-bearing veins of this district are found in granite, and are small but rich. The gold is in part free and in part contained in iron and copper pyrites.

The next gold deposits of any consequence in a northerly direction are found along the western slope of the White Mountains, east and northeast of Bishop Creek. This mineral belt extends from Redding Cañon north about 10 miles, and is characterized by a great variety of formations. In Redding Cañon are small but rich veins of gold-bearing quartz. On the surface the gold is found free, but there are traces of sulphurets. The country rock is granite. One mile north is the Polita Mine, where occurs a vein of free-milling gold ore inclosed in limestone. The quartz is quite different from that of veins found in granite, being very porous and friable, and in places is almost replaced by oxides of iron in varying colors. Farther north is the Yellow Jacket Mine, where the vein is inclosed in slate. Still farther north is the Southern Belle, also in slate. The soft ores heavily impregnated with iron resemble that of the Polita. Several miles distant are the Dark Horse and Mabel mines, whose veins are inclosed in limestone. The quartz is friable and deeply stained with oxides of iron. The Sacramento Mine terminates this mineral belt on the north. Here is a rather flat ledge in granite. The quartz is hard but honeycombed, and contains a large amount of pyrites. The Polita and Southern Belle are the deepest mines in the belt, and have been found to maintain their strength in the deepest portions.

Gold is not found in paying quantities in the northern part of the

White Mountains, but silver appears in places. Much of the area occupied by the metamorphic rocks has been more or less mineralized, as shown by the abundance of iron pyrites producing a reddened surface.

Gold and silver both occur in the mountains between Bishop Creek and Mono Lake. The gold is found mostly between Benton and Owen River. With the exception of the Wild Rose, Neal, and one or two other properties, the mines have been but slightly worked. The veins are generally small. The country rock is granite. Silver and gold are associated in about equal proportion in the Wild Rose. The vein on which the Neal Mine is situated is remarkable for its size and regularity, and for the distance which it can be traced.

From Pine Creek north the eastern slope of the Sierra Nevada consists in part of metamorphic rocks. These, as well as the granites, are mineralized in many places. The deeply reddened rocks form an almost continuous but irregular line from Pine Creek north to Alpine County. The first gold deposits are found at Mammoth, in southwestern Mono County. Here are a number of veins outcropping on what is known as Mineral Hill. Many claims were located and a large amount of work done here years ago, but most of the ore is low grade and not free milling. It would appear that mining might be successfully carried on with the present methods for reducing low-grade ores.

Gold-bearing veins have been found southwest of Grant Lake, and on Lee Vining Creek, but have not been developed. West of Mono Lake, between Lee Vining and Mill creeks, are a number of gold prospects. Some of them are rich, but there has not yet been enough development work done to show their extent. The country rock consists partly of granite and partly of the metamorphic series.

One of the most important mining districts situated on the eastern scarp of the Sierra is the Homer, near the head of Mill Creek Cañon. A large mass of granite has been intruded through the metamorphic series on the southern side of the cañon. The gold-bearing quartz veins are mostly confined to the granite, which culminates in Mount Scowdan, 11,000 ft. high. The quartzites, porphyries, and slates have been impregnated with iron pyrites and present deeply reddened surfaces. Mount Scowdan is fairly seamed with quartz veins on the north, southeast, and over the summit. The May Lundy group, which has been the main producer, lies on the southeast slope of the mountain. Many of the veins are quite flat, but experience has shown that with increased depth they become steeper. All the ores from this mountain were free milling on the surface, though containing some argentiferous galena. With depth they undoubtedly become more base, as has been demonstrated recently in the May Lundy and Lakeview mines, where in the deeper levels the gold is found almost wholly contained in iron pyrites.

Near Green Creek, between Mill Creek and Bridgeport, are a number of mines, the most important of which is the Dunderberg. Here occurs a well-defined and regular vein inclosed in slaty rocks. On the surface the ore was partly free milling, but at the water-line the gold was found to be contained wholly in iron pyrites.

The mines of the Jordan District are situated north of Mill Creek, on the very edge of the eastern scarp of the Sierra. Here is found a vein of remarkable proportions running north and south between limestone and metamorphic rocks or porphyry. The enormous body of ore, 60 ft. wide in places, carries about equal amounts of gold and silver, and

although free milling on the surface, the deepest workings show an increase in sulphurets.

The Bodie District has been thoroughly described in former reports. It might be added that the country rock is hornblende andesite, an exceptional wall rock for California gold ores. The greatest depth reached, about 1,200 ft., has shown that the rich ores are nearer the surface, becoming poorer below the 500 ft. level. From the fact that the richest ore was the shallowest in the Syndicate Mine on the north and deeper in the mines lying south, it has been thought that the ore shoot might pitch south, and that rich ores still exist in that direction. Be this as it may, the ore of this group of veins has apparently given out at a moderate depth, a condition quite exceptional in the gold regions of California. The ores are free milling at the greatest depth reached, appearing to differ in that respect from almost all the mines examined on the eastern side of the Sierra.

Of the gold ores of the region under discussion it may be said, with few exceptions, that in depth they will become more base, the water-line varying greatly in different sections, and to successfully work a large number of these deposits provision must be made for concentrating the sulphurets. Although no great depth has been reached in most of the mines outside of Bodie, yet in many places the developments have been sufficient to indicate that the ores go down.

The deposits of silver and lead are more easily described under two heads, namely: silver merely, and silver-lead or argentiferous galena. Under silver ores are included argentiferous copper glance, stromeyerite, stetefeldtite or partzite, gray copper, and argentite. These ores are found chiefly in quartz veins generally well defined and similar to those of gold, with which they are often associated. The distinctly silver-lead deposits are, on the other hand, found more often in chamber form; that is, in irregular bunches scattered along a mineralized zone.

The Panamint range is noted particularly for its silver deposits, argentiferous copper glance, stromeyerite, etc., and the rare occurrence of lead ores. The two most important districts are Panamint and Wild Rose. The mines of the former are grouped mostly around the town of Panamint. The deposits are in the form of well-defined veins with a gangue of quartz, and are inclosed in limestone or other metamorphic rocks. The ores are mostly low grade, and at present are not profitable to work. The section is well favored with wood and water.

Wild Rose Springs are situated in the northern part of the range. The silver mines lie east and north of the springs from 3 to 15 miles, many being remote from water. Although generally occurring in vein form, the ores being similar to those at Panamint, the deposits are not so regular or well defined; a condition due, perhaps, in part, to the exceedingly broken character of the country, the dynamical action having been intense. Some of the ores are high grade, but so little depth has been reached that their extent is not known.

About Benton, and particularly in the vicinity of Blind Spring Hill, extensive deposits of rich silver ores have been worked for many years. Those in Blind Spring Hill occur in well-defined veins in granite, the ore being part galena and part stetefeldtite or partzite, the latter carrying the bulk of the silver. These mines are by no means exhausted, but are mostly idle because of the low price of silver.

The silver mines of the Patterson District, Sweetwater range, are at

present mostly idle. No lead ores are found here. The Kentuck group of mines has been a large producer in years past. The California Comstock and many others in the district have not yet been sufficiently prospected to demonstrate their value, although it is believed that large bodies of ore are present which can be mined if silver rise in value. Many of the veins found in the lower portion of the Sweetwater Mountains have been worked for gold.

The metaliferous deposits of Alpine County occur partly in andesitic tufas and partly in diabase and metamorphic rocks. About Monitor the degree of mineralization shown by the decomposed yellow and reddish-stained mountains is remarkable. Comparatively little galena is found here. In addition to the silver there is a small content of gold. Enargite is the rich silver ore.

The northern part of the Argus and the southern part of the Inyo ranges are noted for their extensive deposits of argentiferous lead ores. It is from the mines in the vicinity of Darwin and Cerro Gordo that the great bulk of the lead and silver of the region has come. A mineralized zone extends from the Modock Mines to and past Darwin. The mines at Modock and Minnietta are characterized particularly by the chamber form of the deposits. They have been opened to a depth of over 1,100 ft., and found to maintain the same character as near the surface. The Defiance Mine at Darwin has reached a depth of 600 ft. and recently a rich strike has been made. At Cerro Gordo the deep workings have been abandoned for the present, at least.

On the eastern slope of the White Mountain range argentiferous lead ores are found, but no work is being done on them at present.

Several small beds of iron are known in the southern part of Inyo County, but probably they are not extensive enough to be developed for that metal. They have been used quite extensively in the smelting of silver ores at Darwin and Modock. Copper is known to exist in Mono and Alpine counties, but has not yet been profitably mined.

The antimony (stibnite) deposits of Wild Rose Springs will be valuable when better facilities for shipment exist.

Quarries of marble and travertine have been opened, while an excellent granite is found in the Argus range.

The important borax deposits occur in Saline Valley, Death Valley, Salt Wells Valley, and in northern San Bernardino County.

GEOLOGY OF A SECTION OF EL DORADO COUNTY.

EMBRACING PORTIONS OF THE PEKIN, AGRA, GREEN VALLEY, PILOT KNOB, AND MUD SPRINGS DISTRICTS.

By HAROLD W. FAIRBANKS.

In the southern part of El Dorado County and west of the so-called "Mother Lode," lies a mineral region of considerable importance. It has a width of about 5 miles west from the Logtown divide, and extends from the Cosumnes River north to the middle of the county. It is separated from the "Mother Lode" by the great diabase ridge which extends north from the Cosumnes River nearly to the town of El Dorado, while for a number of miles on the west it is bordered by a large area of gabbro. The sedimentary rocks of the district are more prominent in the eastern portion, and consist almost entirely of black slate, which is geologically a portion of the black slates of the "Mother Lode," the whole being known as the Mariposa beds. The general strike of the slates, when not disturbed by local eruptives, is north and south, dip nearly or quite vertical. The greater portion of the rocks of the district are, however, to be classed among the eruptives. They are in many cases greatly decomposed and, in the induced schistose structure, are often mistaken for metamorphosed sediments. This schistose structure has also a north and south direction. The variation in character and composition of these eruptives is quite remarkable; and though many of them possess a dike form with greatest length from north to south, yet others occur with the greatest irregularity, with reference both to form and position. Especially is this the case south of Shingle Springs in the vicinity of the Big Cañon Mine. The direction of the numerous quartz veins corresponds in general to the strike of the slaty or schistose structure of the country. This region was rich in placer gold in the early days, but for some reason quartz mining seems not to have been generally successful. This has been due in part to the "pocket" character of many of the veins. The low-grade but more uniform gold deposits have not until recently been systematically developed. In addition to the north and south system of veins there is an east and west system, less important, however, and always "pockety." The presence of *quicksilver* in addition to gold is a peculiar feature of this section. The most important rock formations, slate, greenstone, serpentine, and porphyries, will be described in the order of their extent.

As before mentioned, slate forms the eastern part of the district, forming a belt from a mile to a mile and a half wide. It is cut by many dikes of a fine green rock, and others of hornblende and quartz porphyry. With few exceptions the quartz veins are not found in the slate, but at the contact with the eruptives or inclosed in them. Near the Fort Yuma Mine a small vein, perhaps 15 in. thick, of *chromite* is found in the slate, no serpentine cropping within a mile or more. This is the first instance in this State which has come to my notice of chromite occurring associated with any other rock than serpentine, with which it has seemed to be genetically related.

The greenstone or greenstone schist, varying to talcose schist, forms a

T.8N.R11E.
T.8N.R12E.
T.5N.R11E.
T.5N.R12E.
T.4N.R11E.
T.4N.R12E.

T.5N.R.3E.
T.5N.R.2E.
T.4N.R.3E.

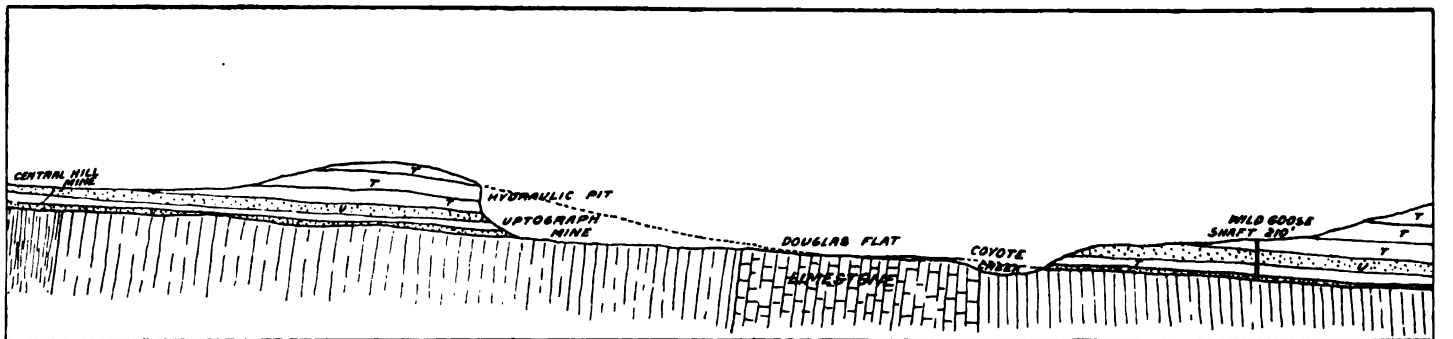
At the Central Hill Mine the volcanic cap has been completely removed by erosion and the broad upper lead swept broadcast over the immediate vicinity, forming rich superficial placer deposits, which were mostly worked out many years ago. A layer of white volcanic ash (tufa) separates the upper and lower leads. In the Uptograph Mine only the basalt and the upper part of the tufa have been eroded, leaving nearly 100 ft. of white tufa capping the upper lead, which is separated from the channel lead by about 15 ft. of tufa. This channel is quite variable in width and also in grade. In the Uptograph Mine the channel is 40 to 60 ft. wide, narrowing with a heavy grade to 10 or 20 ft. In Vallecito Flat the channel is over 100 ft. wide, and below the confluence of the tributary channels is more than 200 ft. The upper lead is exposed more than 1,000 ft. wide on Coyote Creek, half a mile above the village of Vallecito.

East of the Central Hill channel is another capped with brown volcanic mud, which is overlaid by white tufa, and this in turn by black basalt. This channel comes from the northeast, and has been identified as far in that direction as Sec. 22, T. 5 N., R. 15 E., M. D. M. The channel comes from the direction of the Calaveras Big Trees. Its course is southwest as far as Vallecito, where it turns south and then southeast, crossing the Stanislaus River into Tuolumne County. It is undoubtedly a portion of the great Table Mountain series. In Calaveras County it is known as the Cataract channel. The channel has been worked here and there, and a few men are employed all the year drifting. The greater part of the channel remains intact, but has suffered more or less disturbance, the strata often being found tilted.

That portion of the Central Hill channel lying between Vallecito and Altaville is largely unworked. Between Altaville and San Andreas the channel has been worked in many places both by hydraulic and drift methods. Drift mining on a small scale is being carried on in a few claims only. A great deal of this portion of the Central Hill channel has never been worked. By far the larger portion of the channel, from the vicinity of Vallecito to San Andreas, is covered by agricultural patents.

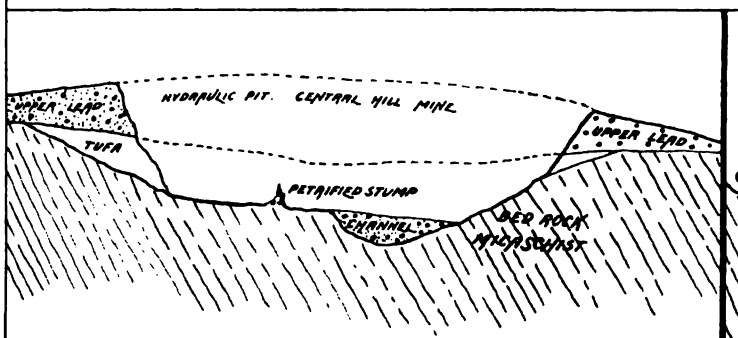
High lava-capped ridges on the north side of Mokelumne River mark the course of a gravel channel, which, with its lateral branches, constitute a large system. It enters Calaveras County about 2½ miles east of West Point on the high hills south of Mokelumne River, and extends in a southerly and southwesterly direction toward San Andreas, passing not far from the village of El Dorado. The sinuous course of this stream, the main branch of which is called Fort Mountain channel, is laid down on the map.

The erosion of this channel system has been considerable, but the greater portion remains. It has been "drifted" to a limited extent in many places, and in a few places where the channel has been exposed by the erosion of recent streams, hydraulicking was formerly employed. Within a year or two marked attention has been paid to this channel by organized companies for the purpose of drifting, as most of the bedrock lies below the level of present surface drainage of the country. Near El Dorado, on the Sheppard Mines, a well-boring plant has been used to advantage in determining the depth of underlying gravel, and the probable yield of gold per ton. The depth to bedrock ranges from 50 ft. in the cañons to 400 ft. and even more on the ridges. A

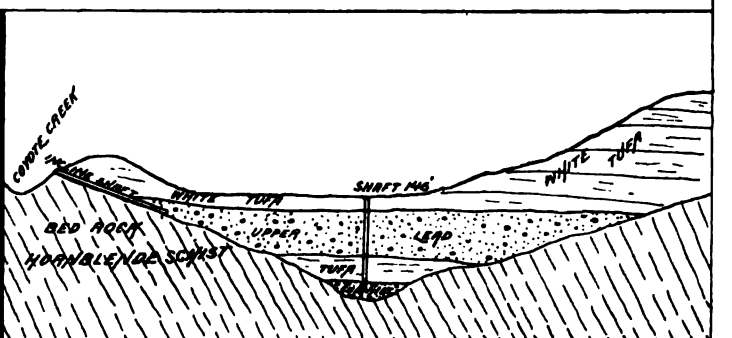


T.. TUFA
V. .. UPPER LEAD
C. .. CHANNEL

LONGITUDINAL SECTION CENTRAL CHANNEL, FROM CENTRAL HILL MINE TO EAST SIDE OF COYOTE CREEK
DISTANCE 7500 ft. GRADE 300 ft to ONE MILE.



CROSS SECTION CENTRAL HILL MINE NEAR MURPHY'S SHOWING EROSION OF UPPER LEAD.



CROSS SECTION CENTRAL HILL CHANNEL ½ MILE ABOVE VALLECITO. WIDTH OF UPPER LEAD 700-1000 ft.

them weigh 300 tons, and many of them exceed 50 tons in weight. There is no doubt that they are of local origin, and came into their present position by becoming detached from the rim rocks, which were doubtless steep. The rocks lying on the gravel were evidently carried down stream a short distance at the time of a great flood, or series of floods, which, while removing large quantities of gravel, permitted the great rocks to sink lower, but not moving them any considerable distance. The present position and appearance of these masses indicate that the superficial gravel was swept away quickly, as the long-continued scouring of sand and water would certainly have resulted in rounding the masses of diabase.

MOKELUMNE HILL SYSTEM.

As has been stated, the system of ancient river beds in the vicinity of Mokelumne Hill is very complex. An area of 20 square miles was investigated for the purpose of determining their geological relations to one another and to the Central Hill-Fort Mountain systems. Nine distinct channels, having each its own peculiar characteristics and geological age, were identified and platted on the map. It was found that the relative altitude of the several channels could not be taken as an indication of their respective age, though ordinarily the higher channels are the older and the low ones younger; that is, more recent. The channels of greater altitude lie high above the modern drainage system, while the low ones are still lower than the gulches in their immediate vicinity. The Mokelumne River, however, has cut its magnificent cañon 500 ft. deeper than the lowest of these ancient rivers. With two exceptions, the Kreamer and the Concentrator channels, the relative age of the channels is determined by the relative altitude. The two exceptions are not found intersecting any of the other channels, and their relation to the rest is in some doubt. On a petrographical basis, the Kreamer channel would be considered younger than most of the others, notwithstanding the fact that it is a high channel. The wash consists of quartz and lava bowlders, cobbles, and gravel.

The Concentrator channel is lower than its near neighbor, the Duryea channel, but is evidently older. These two important channels lie side by side for several miles, having been identified in Butte Basin in Amador County.

A great portion of the deeper channels (by which is meant those of lowest altitude) are still unworked. A great amount of the Old Woman's Gulch channel and the Chile Gulch channel is not worked out. The high channels are mostly exhausted, having been worked years ago, producing millions of dollars. It is stated by the mining men of this vicinity that the tailings in the Chile Gulch contain $5,000,000 in gold. Though probably exaggerated, there is doubtless a large amount which cannot be extracted for lack of dumping ground.

Within the southern limits of Mokelumne Hill, beneath Stockton ridge, is the highest and oldest channel of the district. It was fabulously rich. The hill is a labyrinth of shafts and drifts. Little could be learned of this famous channel. Its course is south. Under Stockton ridge it was cut by the more recent channels coming in from the west. A remnant of a channel 3 miles south is probably a portion of this channel.

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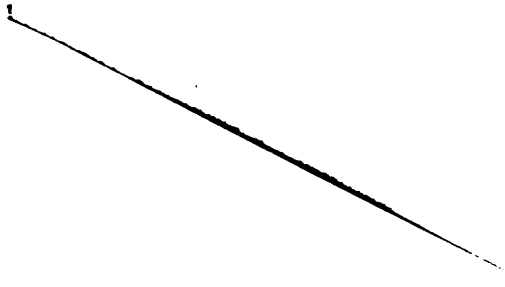

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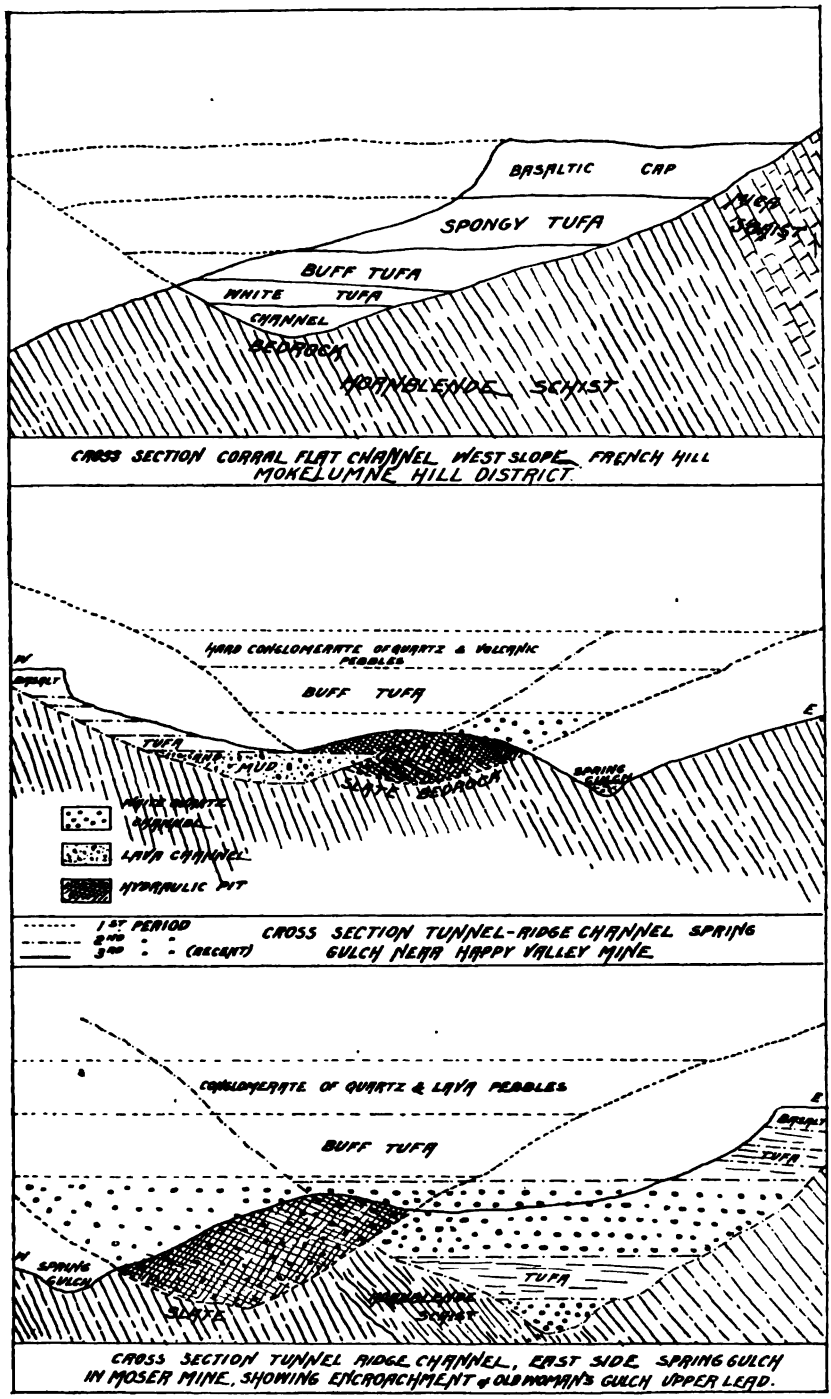


CROSS SECTION CORRAL FLAT CHANNEL WEST SLOPE FRENCH HILL MOKELUMNE HILL DISTRICT.

CROSS SECTION TUNNEL-RIDGE CHANNEL SPRING GULCH NEAR HAPPY VALLEY MINE.

CROSS SECTION TUNNEL RIDGE CHANNEL, EAST SIDE SPRING GULCH IN MOSER MINE, SHOWING ENCROACHMENT of OLD WOMAN'S GULCH UPPER LEAD.

At the northeast corner of the town is an eminence called French Hill. On its west side, half way up the hill, is a remnant of channel which is a portion of the famous Corral Flat channel, which also extended under Stockton ridge in a southwesterly direction. This is said to have been the most productive channel for its size of any in the district. The characteristic features of this channel are the uniformly gray color of the wash; the large amount of bluish slaty quartzose rock; relatively small quantity of well-rounded quartz bowlders; blue quartzite and considerable eruptive rock, felsitic and granular, having a smooth, well-washed appearance. The most prominent feature is the numerous cobbles and bowlders of hematite. The channel on French Hill is 40 to 60 ft. wide. It is somewhat wider under Corral Flat. The large angular quartz bowlders found in the channel on French Hill were derived from a massive quartz vein a short distance to the east. The channel is capped by a tough, putty-like tufa, which is overlaid by a reddish andesitic lava, containing many well-formed crystals of hornblende.

A mile east of the center of town is the Tunnel Ridge channel. It evidently came from the north side of the Mokelumne River, but makes its first appearance in Happy Valley, from which point it extends south some distance, its course being marked by a succession of large, red hydraulic pits. The larger part of this channel is worked out. The removal by erosion of the lava and tufa from the greater portion of its course adapted it to the hydraulic method of mining. In the Moser Gravel Mine, on Spring Gulch, this channel is 200 ft. wide; 3 miles south its width is about 40 ft.; its average width is 80 ft., and the grade about 100 ft. to the mile, but this is extremely variable. The distinguishing features of this prominent channel are the large amount of white and blue quartz bowlders, some of which are of gigantic size. The wash contains an equal amount of grayish or bluish stratified quartz rock, derived from quartzites and silicious schists; a large amount of sub-angular pieces of slaty and schistose micaceous rock lying high above bedrock and evidently not of local origin; a white micaceous sandstone (a variety of itacolumite, only slightly flexible). Acid lavas, such as felsite, quartz-porphyry, and rhyolite are not found in this channel. The gold of Tunnel Ridge is high grade, a noticeable fact in all channels in which there appears to be an absence of old eruptive rocks (not basalt or andesite), while on the other hand the channels in which such rocks occur generally produce gold of lower grade. As a matter of course this rule or condition will not apply where two channels, one containing old eruptive rocks and the other not, have united to form one channel or have crossed each other. In the latter event the later channel will contain two kinds of gold below the crossing, as well as the channel formed by the union of two such channels, as described.

Tunnel Ridge channel presents a number of interesting cross-sections, showing the encroachment of later channels and the effect of recent erosion.

The Concentrator and Duryea channels make their first appearance in Calaveras County a mile west of Mokelumne Hill as remnants capping a hill. They reappear in their southerly course on the western slope of Stockton ridge, and have been worked extensively under that lava-capped mountain. They lie within 200 ft. of each other for more

than a mile, but about the middle of the ridge they diverge, the Duryea channel maintaining a nearly straight course, and the Concentrator channel bearing to the south. The Duryea channel appears on the west side of Chile Gulch, a mile south of Mokelumne Hill, the Concentrator being again exposed in a large hydraulic pit opposite the Chappellet drift mine, 2 miles farther down the gulch. More than a million cubic yards of gravel have been washed from the Duryea pit, and the workings extended back under the Stockton ridge for several thousand feet. This famous channel is distinguished from all others of the district by its almost exclusive quartz wash. Rounded, smooth bowlders and cobbles and angular or sub-angular masses of white quartz and quartz sand constitute the material of this channel to the exclusion of almost everything else; occasionally a gray or bluish bowlder of quartzite may be observed, but no eruptive rocks, iron ores, or other material is seen. The gold of this channel is high grade.

The Concentrator channel has a heavy wash of quartz and quartzite and considerable hematite. The variety of rock, while not large, is easily distinguished from that of the Duryea channel. Both of these large channels are cut out by the Chile Gulch deep lead, and have never again been positively identified to the south. They apparently merge into other channels or are eroded entirely. There is some reason to believe that the Duryea channel joins the Tunnel Ridge channel.

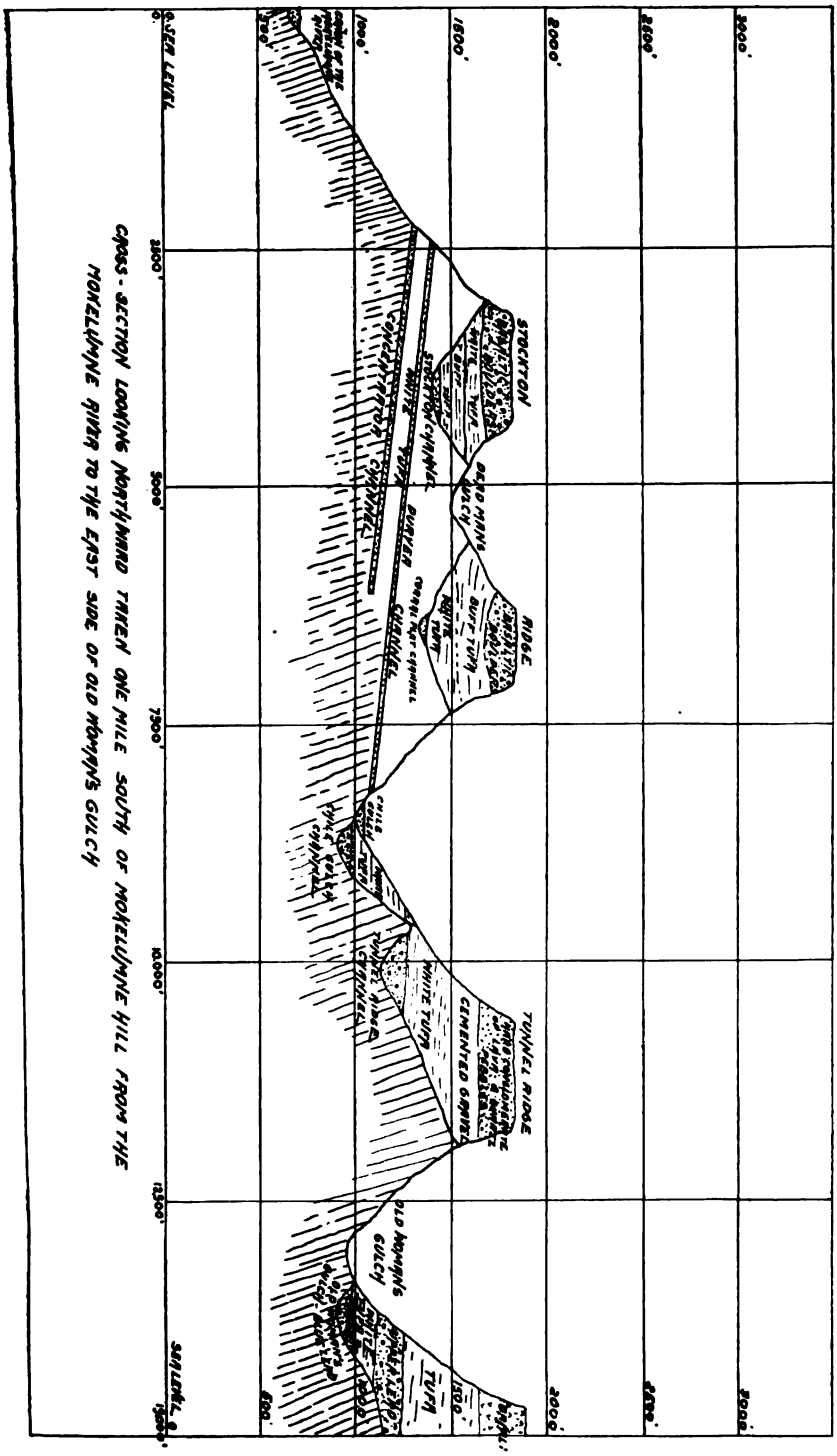
Two miles northeast of Mokelumne Hill is a gutter-like channel 20 to 60 ft. wide, with steep rims. The grade is about 80 ft. to the mile in that portion of its course. It is very sinuous; the most erratic channel, in fact, of any in this region. Along its upper course, between Indian Gulch and Mokelumne River, the tufa which at one time covered the gravel has been mostly removed by erosion, which has also cut out large portions of the gravel. The gulches below were very rich and were worked out years ago. Active mining operations are in progress on one portion of this channel, at the Phillips Mine, the hydraulic method being employed. This channel comes to an abrupt termination on the east side of Indian Gulch, in what is known as the Gopher claim. The hydraulic pits which mark the course of this channel are deep red, and the wash consists of white and dark-bluish quartz bowlders and cobbles, silicious and light-brown ironstone, masses of flint, a small amount of hematite in cobbles and pebbles, considerable slaty and schistose bedrock, and more or less rock of igneous origin. The wash, though deep red where oxidized, is blue or greenish-blue near bedrock where atmospheric agencies have not affected it. Twenty feet above bedrock the gravel is found to be interstratified with irregular sheets of tufa having a peculiar light yellowish-green or bluish shade.

The character of the gravel, the appearance of the unoxidized wash, the interstratified tufa, the sinuous course of the channel, and its every important feature are so similar to the Chile Gulch blue lead that they are thought to be identical.

From the break on Indian Gulch to the point where the Chile Gulch lead is first found on the west side of Stockton ridge, the distance on the presumed course of the channel is about 2½ miles. The difference in altitude between the two points in question, as read by barometer, corresponds very fairly with the normal grade of the channel, which is about 80 ft. to the mile. In its passage under Stockton ridge, the Chile Gulch channel cuts out all the older channels in its course, viz., the

Stockton ridge, Corral Flat, and Duryea channels. It first appears on the east side of the Chile Gulch, half a mile south of Mokelumne Hill, where it is said to be about 60 ft. below the present bottom of Chile Gulch. In a general way it follows the gulch, but is much more sinuous than the modern stream, the ancient river sweeping from side to side, and at one place making a large horseshoe bend, as at the What Cheer Mine, where it is half a mile west of Chile Gulch. Its course is quite well defined for 2½ miles below the Duryea Mine, but it has been lost in the south end of the Chappellet Mine, and its course beyond has heretofore been a matter of conjecture, but there is much reason to believe that a continuation of the Chile Gulch channel is found in the channel whose course is marked by a series of red hydraulic pits beginning on the opposite side of Tunnel ridge from the Chappellet Mine and extending for some distance on either side of the road in the direction of San Andreas. This channel has every important feature of the Chile Gulch channel, and particularly resembles that portion of the stream in question found in the series of red pits of the Gopher and Phillips mines, northeast of Mokelumne Hill. The grade of this lower section of channel is extremely irregular. Where first observed opposite the Chappellet Mine, in Old Woman's Gulch, on the east side of Tunnel ridge, the bedrock is 15 ft. higher, by aneroid reading, than the bottom of the shaft in the Chappellet Mine, half a mile distant. Southward from the pit, on the west side of Old Woman's Gulch, there is scarcely any grade for half a mile, but in the next half mile toward San Andreas there is a heavy grade to the northward, beyond a moderate grade southward is again found, and near the property of the Spring Gulch Placer Mining Company the last traces of this channel are seen. Whether it also turned toward Central Hill is not known, though it is presumed it did. The southern end of the channel is only 3½ miles from the town of San Andreas. The channel is completely worked out, so its probable course becomes interesting from a geological standpoint only.

From the present knowledge of the channel system of this region it appears that the deep channel, called the Old Woman's Gulch Blue Lead, is one of the most recent of these ancient streams, having cut out every stream in its course, which is remarkably straight, with a broad upper lead. It first appears in the Maguire Mine, on the east side of Indian Gulch, a mile north of Mokelumne Hill, and but a few hundred feet northeast of the Happy Valley hydraulic pit, on the Tunnel Ridge channel. It courses in a southwesterly direction to Old Woman's Gulch, and from there its course lies mostly along the east side of that gulch as far south as Williams' ranch, on the San Andreas and Mokelumne Hill road; here it crosses Old Woman's Gulch and passes under Tunnel Ridge, intersecting the Tunnel Ridge and Chile Gulch channels. The upper lead is separated from the channel by about 60 ft. of light tufa. Both the channel and the upper lead have been worked at many points. The entire course of this channel from Indian Gulch for 2 miles or more to the south lies beneath the drainage of Old Woman's Gulch, and the problem of controlling the water has become a serious one to the owners. It would seem that a consolidation of interests and the running of a long drain tunnel would render the working of this channel practicable. The large amount of tough clay in this wash renders the speedy handling of the material difficult. It has been the practice of the miners to spread the gravel out in shallow layers; the "slacking"



CROSS-SECTION LOOKING NORTHWARD TAKEN ONE MILE SOUTH OF MOKELUMNE HILL FROM THE MOKELUMNE RIVER TO THE EAST SIDE OF OLD MORMON'S GULCH

or "weathering" by exposure to the atmosphere seems to facilitate the recovery of the gold in the sluices. The course of this channel beyond the point where it enters Tunnel Ridge is toward Central Hill.

A channel filled with lava-wash (basaltic) and a few quartz bowlders and cobbles, crosses the top of Stockton ridge in an easterly direction. A similar channel is found on the west side of the Tunnel Ridge channel, near Happy Valley. These two remnants appear to be portions of the same channel. It has been drifted, but not extensively. Though actually the highest channel of the region it is apparently the most recent.

The Kreamer channel lies well to the west and has a course toward Golden Gate Mountain. It is being worked in places by the drift method. This channel appears to be the same as that passing through the Lava shaft and Augostini claims, near Central Hill, and it is not unlikely that the Benson Mine, on the west side of Latimer Gulch, is on this channel also.

An approximate estimate of the amount of gold still remaining in unworked portions of the channels of Calaveras County would be difficult to make, but basing such an estimate on the knowledge of what certain channels have already produced, and consulting all available data as to extent, average width, and depth, it would seem that $15,000,000 is not an extravagant estimate of the quantity of gold that may be obtained by drifting. Besides this, it is probable that the upper strata contain as much as $25,000,000 more, a large portion of which cannot, with present knowledge and facilities, be obtained economically.

The value of the gold from the several channels, as obtained from a gentleman residing at Mokelumne Hill, and who has mined in several of the channels and bought a large amount of the gold of the district, is given as follows:

Phillips Mine, upper end of Chile Gulch channel	$18 25 per oz.
Chile Gulch Deep Lead	18 00 per oz.
Tunnel Ridge channel	19 50 per oz.
Old Woman's Gulch Blue Lead	17 50 per oz.
French Hill-Corral Flat channel	18 50 per oz.
Stockton Ridge channel	18 00 per oz.
Duryea channel	18 00 per oz.
Concentrator channel	17 75 per oz.
Kreamer channel	18 50 per oz.
Red pits on San Andreas road, presumed to be lower end of the Chili Gulch channel (about)	17 50 per oz.

It will be understood that these are the prices paid for the gold, and that they do not represent accurately the fineness of the gold.

The subject of Ancient River Channels in California has heretofore been treated at length in our VIIIth, IXth, and Xth Reports, pp. 736, 105, 435.

GEOLOGY OF NORTHERN VENTURA, SANTA BARBARA, SAN LUIS OBISPO, MONTEREY, AND SAN BENITO COUNTIES.

By HAROLD W. FAIRBANKS.

The field work for 1893 in the southern coast ranges occupied five months. The writer, in company with R. P. Heagan, as assistant, traveled over 2,000 miles, visiting every known mineral deposit of any value, and examining the geology as far as was possible with the time at disposal. The geology was found to be more complex than the hasty reconnoissance the previous summer had indicated. Many interesting facts were discovered, for the full elucidation of which more detailed work is required. It is believed, however, that the work has been sufficiently accurate to serve as a basis for future detailed investigations.

Very little has been known of the geology of this portion of the coast ranges. The reports of the Pacific Railroad Survey, and of the former State Geological Survey under Professor Whitney, comprise the results of most of the work done here. The southern portion of the region studied, embracing as it does the San Emedio range, where the San Bernardino Sierra and the southern Sierra Nevada unite, is of great geological interest. The three dominating peaks of the San Emedio range are the Alamo, Frazer, and Pinos, ranging in the order named from over 7,000 to 9,000 ft. in elevation. This elevated region of crystalline rocks has a shape somewhat like a V, the apex formed by Mount Pinos lying to the west, while the arms extend one to the northeast, forming the Tehachapi range, the other southeast under the name of the Sierra Libre. Between these ranges is Antelope Valley, the western arm of the Mojave Desert.

Previous to the deposit of the Miocene-Tertiary this region had assumed topographical features somewhat similar to those of the present day, but during the Miocene a great submergence took place and only the tops of the highest ranges rose above the water. The Tertiary beds, consisting of sands and clays, were deposited in the previously eroded valleys, and to-day somewhat mask the real geological structure. The Miocene which forms a large part of the central and southern parts of Ventura County, extends up Soledad Cañon nearly to the Mojave Desert, while beds of the same age in the valley of the Piru completely cut off the Sierra Libre from the San Emedio range and extend through to Antelope Valley. The beds rise to an altitude of over 5,000 ft. about the sides of Frazer Mountain, where they are quite undisturbed and present a somewhat terrace-like appearance. The surface in places has apparently undergone scarcely any erosion since the elevation from beneath the sea.

The Sierra Libre range consists chiefly of a gneissoid mass with some granite, and is generally deeply decomposed. The gneiss is thin-bedded,

and in the San Francisquito Pass exhibits the most contorted foliation, while it is intersected in all directions by irregular quartz veins.

Tertiary beds extend up to the summit west of Gorman Station, where the old Los Angeles stage road crosses, and rise much higher against the slopes of Frazer Mountain. Tertiary beds appear again about the sides of Cuddy's Valley, between Mount Pinos and Frazer Mountain, and extend over the divide to Lockwood Valley. Westward from the latter point they become very prominently developed, forming the divide on the head of the Cuyama, and a great extent of barren mountainous country southwest and west of Mount Pinos. About Cuddy's Valley, which has an elevation of about 4,500 ft., the Tertiary rises nearly 1,500 ft. and is very distinctly terraced, three being noticeable on the north slope of Frazer Mountain. Overlying these clays unconformably are heavy deposits of bowlders and gravel, which in many places are rich in gold. These gravels border all the high peaks of crystalline rock, and are particularly extensive along the head of the Piru between Lockwood Valley and Rays Creek. The older sands and clays carry no gold, indicating a submergence of the whole range during their deposition, and a period of partial submergence during the formation of the gold-bearing gravels. The gold has undoubtedly been derived from the quartz veins in the schists near by. Beginning about 2½ miles above the mouth of Lockwood Creek on the Piru are a series of terraced gravel deposits, extending in a westerly direction to San Quelmo Cañon (about 15 miles), which are said to carry everywhere more or less gold. Desultory mining has been carried on here for many years; in fact, these are said to be the earliest worked placers in the State. These gravels seem to have belonged to an ancient stream which diverged from the course of the present Piru more toward Mount Pinos, and, judging from the bowlders, it may have headed there. South of the Piru at this point there are no gold-bearing gravels. The gold is not greatly worn and generally rather coarse. Farther down the Piru the gulches which head in the Alamo Mountain also contain gold.

Beginning on the southern side of the Piru near the mouth of the Alamo Creek, and extending in a northwest direction, is a series of very peculiar schists and gneisses with which the most important gold-bearing quartz veins are associated. These form a large part of Frazer Mountain, but are best exposed along the Piru and Lockwood creeks. They extend as far west as the southern slope of Mount Pinos. The strike is a little north of west, and dip to the north at a high angle. The schists are characterized by the development of alternate bands of feldspathic and hornblendic or micaceous material. Corroded feldspar crystals are scattered through the gneisses, being inclosed in a matrix consisting of irregular bands of gnarled, stringy masses of feldspathic material and layers of mica or hornblende. The gneissoid rocks often blend into well-characterized "eye" gneiss; that is, gneiss in which the generally large crystals of feldspar have undergone partial re-fusion, giving them a more or less elliptical form. These porphyritic gneisses are sometimes sharply differentiated from the schists, which at first sight seem to be of sedimentary origin and at other times blend into them. The porphyritic rocks sometimes appear as bunches in the dark compact schists. Several dikes of the "eye" gneiss were noted which had flesh-colored feldspar crystals 2 to 3 in. long and which were sharply defined from the inclosing rocks, while others which were very similar

in character, but not so coarse, seemed to blend by transitions through types in which the feldspar was more corroded to those in which it appeared as stringy masses, and finally into a typical hornblende schist. The bunchy feldspathic aggregates blending into bands undoubtedly represent crystals which had become softened by partial re-fusion and then been drawn out in the moving magma. This character is very finely shown on the Piru in the vicinity of the Castac Mine. It would seem probable that the greater portion of these hornblende and mica schists formed originally a portion of an eruptive mass.

The most easterly mine in this belt is the Castac, on the south bank of the Piru. The vein is inclosed in the crystalline schists and has a northwest and southeast course. Numerous small quartz veins occur in the schists on the southern slope of Frazer Mountain. The veins are either in a fine-grained variety of the "eye" gneiss, as, for example, the Frazer, or on the contact of coarse dikes of a flesh-colored variety with narrow bands of schists, as on the southwestern slope of the mountain, where are situated the Bunker Hill, Fairview, and White Mule mines. The mineral deposits of the San Emedio Cañon have an entirely different character.

The region about Frazer Mountain is remarkable for the number and variety of the volcanic rocks. A banded liparite appears on the northern slope of the Sierra Libre range. At Gorman Station is an outcrop of a dark basaltic rock. Near the Frazer Mine is a dike of fine-grained liparite, while on the northern slope of the mountain are coarse liparites with more basic amygdaloidal varieties. On the southern slope of Mount Pinos are extensive areas of a variety of lavas, mostly basic. The San Emedio range has been the scene of great strain and faulting along an east and west line, not only in Tertiary times, as indicated by the volcanic rocks, but also quite recently. The effects produced by a great earthquake, probably that of 1872, can be traced a number of miles along the stage road from Gorman Station to Antelope Valley, where large depressions still exist. The fissure extended west across the San Emedio Cañon for an unknown distance. Abundant springs gush out along this fault line; in fact, it can be traced by them.

Limestone in a highly crystalline condition outcrops in the granite near Gorman Station. Numerous but detached areas appear in a westerly direction from this point, being especially prominent in the range north of Cuddy's Valley, and in the San Emedio Cañon. Near Gorman Station, as well as in a branch of San Emedio Cañon, iron ores occur in conjunction with the limestone.

The northern portion of Mount Pinos consists of mica and hornblende schists, dipping at a high angle to the south. Granite, however, appears some distance down the San Emedio Cañon where it rises in peaks 6,000 ft. high. The San Emedio antimony mines are located on a high granite mountain on the east side of the cañon. A short distance below the old works the crystalline rocks are succeeded by the Eocene-Tertiary, which consists to a great extent of sandstone, rising in cliffs nearly 1,000 ft. high, and exposing the stratification very clearly.

A ridge of crystalline rocks extends northwestward from Mount Pinos for a number of miles, when it sinks beneath the Tertiary, thus terminating the exposed portion of the crystalline axis, which, without doubt, continues still farther underneath the clays and sandstones to connect with the San Luis range of granitic rocks. The Cuyama River for nearly

a hundred miles down from its source may be said in a general way to divide the Miocene from the Chico; the Tertiary extending northwest from the San Emedio region, to form the parallel ranges bounding the Carisa Plain, while the high ranges in the northern part of Ventura County about the head of the Sespe and San Buenaventura rivers, extending into central Santa Barbara County, consist chiefly of the Chico, with occasional patches of overlying Miocene. About the very head of the Cuyama River, north and northeast of Ozena Post Office, the Miocene clays and sandstones are impregnated to a remarkable degree with alkalies, the dry bed of the streams being almost perfectly white in many places. The upper Sespe flows from west to east between high ranges of unaltered rock, which, judging from the few fossil remains found, belong to the Chico. The highest portion of the range on the north, separating the Sespe from the Cuyama, is called Pine Mountain, having an elevation of about 6,000 ft. The shales and sandstone of this range lie quite flat, dipping slightly to the north. They form the southern half of a synclinal fold, which is very clearly shown in the region about the head of Santa Barbara Cañon. The strike is nearly east and west. A few poorly preserved fossils were collected on the northern slope of Pine Mountain. The following species were made out: *Actæonella oviformis*, Gabb; *Dentalium stamineam*, Gabb; *Fusus remondi*, Gabb; *Turritella* sp.; *Neverita globosa*, Gabb; *Nassa cretacea* (?). This fauna is thus seen to indicate the upper Chico or possibly Tejon. Stratigraphically these beds are from the upper portion of the synclinal fold before mentioned.

Pine Mountain has on its southern slope a strip of Tertiary sandstones and clays which are exposed in bold cliffs facing the Sespe. They dip to the northeast at a small angle, and near the point where the Matillija trail crosses rise fully 1,000 ft. above the valley. They are characterized by an abundance of Miocene fossils. Although no actual contact was observed here with the underlying Chico, everything points to a non-conformity.

The range south of the Sespe rises nearly as high as that on the north, and consists of gray sandstone, generally thin-bedded, and black shale; the strike is a little north of west, and dip either south or north at a high angle. Descending the south side of the range, the Matillija Cañon was followed down to the hot springs, where it opens out to the Santa Ana Valley. The few fossils found indicated the upper portion of the Chico, and were determined as follows: *Fusus martinez*, Gabb; *Meretrix horni*, Gabb; *Crassitella grandis*, Gabb. The shales and sandstone are uniform in character to the mouth of the cañon, but the dip and strike are very irregular, and show a great amount of crushing. The rocks are very clearly exposed in the sides of the cañon, the cliffs being in places fully 1,500 ft. high. The whole width of the Chico exposed in this section must be as much as 12 miles, but so irregular is the dip that no estimate of the thickness can be given. The Santa Ana Valley seems to form the southern boundary of this series. From this point the Miocene extends south and west to the coast. This region is remarkable for the entire absence of eruptives of any kind. Although lavas were reported by the Pacific Railroad Survey, no traces of any were seen during the present investigation.

In a westerly direction, that is, in the eastern part of Santa Barbara County, these ranges unite to form an elevated and very rugged region

Miocene.
Cuyama River.
Pine Mt.
Miocene.
Sespe Creek.
Miocene
Ojai Valley.

Fig. 1.

of which very little is known. As far as our observations were carried it seemed to consist of the Chico overlaid in places by the Miocene. Streams flow from this watershed to every point of the compass, giving rise to the Sespe, the Sisquoc, the Santa Ynez, and important tributaries of the Cuyama. The three important ranges of Santa Barbara County may also be said to start here. These are the Cuyama, the San Rafael, and the Santa Ynez. The Santa Ynez is formed, as far as is known, of Miocene rocks exclusively; the other two of pre-Cretaceous, Cretaceous, and Tertiary. The highest peak to be found in Santa Barbara County rises about 7,000 ft., forming a sort of semi-circle about the head of the Sisquoc.

Santa Barbara Cañon, which opens north to the Cuyama River, shows a good cross-section of that portion of the mountains. Tertiary rocks appear for about 5 miles up the cañon. The beds consist, at the base, of the usual clays, richly impregnated with gypsum. Higher up there is red sandstone, dipping but slightly to the north, that is followed by soft, heavy-bedded sandstone of a light-yellow color. The latter are inclined at a steep angle and rest on the Chico, which consists of dark shale and thin-bedded sandstone, dipping about 70° to the southwest. In appearance these rocks are very similar to those on the Matillija. From this point to the head of the cañon, a distance of about 8 miles, the Chico continues, dipping 60° to 80° to the southwest, and strike N. 60° to 70° W. As the divide is approached the sandstones assume a tawny-yellow color, and contain dark concretions similar to those elsewhere in this series. Although no fossils were found in the cañon, the strata appear to be the direct continuation and of the same age as those crossed on the Matillija trail. On the summit opposite the head of Mono Cañon a reversion of the dip takes place, and the high mountains on the head of the Sisquoc and along the upper Mono Cañon repeat, only in opposite order, the strata passed over in Santa Barbara Cañon. The thickness of this series as shown in the latter cañon is enormous. The dip is quite uniform, and unless the strata are repeated by faulting, of which no traces were observed, it must be 25,000 ft. *Fig. 2* is a section in this cañon.

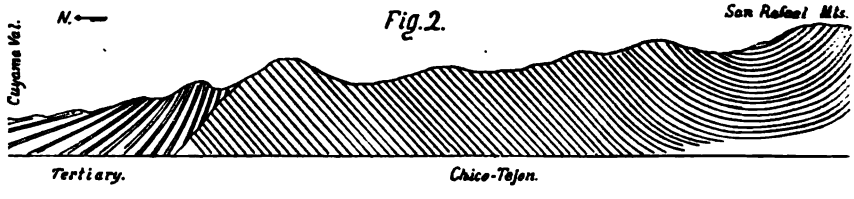


Fig. 2.

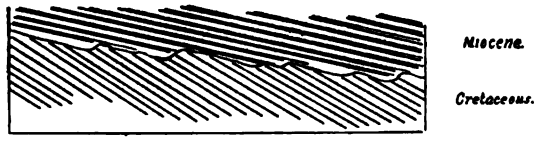
The Cuyama range was crossed about 15 miles west of Santa Barbara Cañon, opposite the Cuyama ranch house. At the point where the trail crosses there is a depression in the Chico, and the light-yellow sandstones so characteristic of the Miocene in this section extend from the eastern side over the summit a short distance. The older gray sandstones and shales appear in the higher portions of the range both north and south. The Miocene sandstones are heavy-bedded, and seem to dip away from the axis of the range at a small angle. The sandstone weathers out in great knobs, and in a cañon north of Montgomery's Potrero forms a very extensive series of high-terraced cliffs, known as

the Painted Rocks. Five terraces appear, each fully 100 ft. high. The rocks exposed in the cañon of the Sisquoc for many miles belong to the Chico, judging from a number of specimens obtained from the cañon a little above the point where the Jackson trail strikes it. The following forms were determined: *Inoceramus; Baculites chicoensis*, Trask; *Bulla horni*, Gabb; *Cinulia obliqua*, Gabb; *Pectunculus veatchi*, Gabb; *Meekia sella*, Gabb.

While dark sandstone and shale form the prevailing rocks, yet there are very extensive beds of bowlder conglomerate. The bowlders are chiefly of the granite type, and sometimes are as much as 3 ft. in diameter. A southerly dip predominates, though that, as well as the strike, is very irregular.

A range of rugged mountains lies south of the Sisquoc between it and the Manzana. The higher portions of these mountains are capped by Miocene sandstones, but slightly disturbed and contrasting strongly with the underlying Cretaceous. As the cañon is ascended, the Cretaceous gradually sinks and the light-yellow sandstones appear in bold bluffs along the water's edge near where the stream divides. The Tertiary overlies the Cretaceous unconformably, a fact which was illustrated by an excellent exposure on the Sisquoc, where the older shales and sandstone dip south about 30° and are overlaid by the Tertiary sandstone, which rests on their irregularly eroded surface with a considerably smaller dip. Iron springs are numerous along the contact. *Fig. 3* illustrates the non-conformity.

Fig. 3.



The three ranges, the Cuyama, the San Rafael, and the intervening one, have each an elevation of about 4,000 ft. along a section between the town of Santa Ynez and the Cuyama ranch house. The geology of this section is illustrated by *Fig. 4*.

The Cuyama Valley has a length of 35 miles, gradually narrowing toward the western end, where the river turns to the southwest and cuts across the Cuyama range. On the north of the valley, and separating it from the Carisa Plain, is a range of high and barren Tertiary hills formed of gypsum-bearing clays and soft sandstones. These rise quite abruptly from the valley, exposing well their stratification. The hills were explored for a dike which was reported to carry silver, and as a result the occurrence of a most interesting eruptive mass was brought to light. An immense dike of the diabase type and rich in analcite was found to extend for several miles in a northerly course on the western slope. At the southern end the width is at least 1,500 ft., narrowing somewhat to the north. The great mass of the rock is so completely decomposed as to give the same contour to the hills as the soft Tertiary beds, and if it were not for the presence of many small but harder dikes traversing it, and for the rather precipitous croppings in the narrow

cañons, its presence would hardly be suspected. The substance from which the analcite has been derived is not certainly known, but it is probably nepheline, or some related mineral. The susceptibility to decay and the disintegrated condition of the whole mass must be due to some mineral of this class. Dikes of somewhat different composition and structure cut through the decomposed portion in every direction. They vary in width from a few inches to nearly 20 ft., and are quite hard and fresh. The analcite is present in some of these dikes in clear glassy grains fully half an inch in diameter. In places they are undergoing decomposition to radial zeolites. The other components of the rock are feldspar (plagioclase), augite, and ilmenite (titanic iron).

The Tertiary has been thrown into a vertical position adjoining the dike and very considerably metamorphosed. This metamorphism consists of a hardening of the clays and their transformation to dark shales, while the sandstone and calcareous strata have been partially recrystallized. A great mass of Tertiary shales has been inclosed in the eruptive mass, as shown in the side of one of the cañons. Excellent specimens, showing large cleavable crystals of diallage and grains of analcite, were obtained from one of the dikes about 15 ft. wide. The large dikes are, as a rule, coarse, but show little difference as regards this character between the centers and the edges.

On the summit of this range, between the Cuyama ranch house and the Carisa Plain, is a series of volcanic beds, probably basalt, interstratified with the Tertiary clays. They vary in thickness from 10 to 100 ft., and extend along the crest for several miles. Judging from the float, another outcrop is to be found in the same line of hills opposite the lower end of the Cuyama Valley.

Toward the lower end of the Cuyama Valley horizontally bedded Miocene hills appear, in places rich in fossil oysters and pectens. The Chico outcrops from underneath these beds, inclined at a considerable angle. Both north and south of the valley the Tertiary itself is considerably inclined. For some distance above the main cañon, and north of the point where it turns to enter the mountains, there are very extensive conglomerates, probably nearly 2,000 ft. in thickness. They form high mountains in the southern part of San Luis Obispo County, being really a continuation of the Cuyama range, only under another name. Continuing in a northwesterly direction, this range becomes still higher until divided by the San Luis Valley, at the upper end of which the Salinas River rises. The northern arm unites with and overlies the southern portion of the San Luis range of granitic rocks. The southern arm forms the watershed between the Salinas and the Alamo, the Arroyo Grande, and the Corral de Piedra creeks, which empty directly into the ocean. In its northwest prolongation this range forms the Santa Lucia.

The Cuyama River turns to the southwest several miles below where it enters the cañon, and for a distance of 20 miles cuts through the mountains at right angles to the strike of the rocks, giving an excellent section of all the formations represented in Santa Barbara County except the Pliocene. For several miles before turning to the southwest the river is bordered by heavy-bedded conglomerates, dipping southwest at about 30°. At the very point where the course changes, shales and dark sandstones appear underlying and nearly level. There is an appearance of non-conformity, but both series probably belong to the Cretaceous. The presence of pebbles similar to the underlying sandstone in

the conglomerate near its base, and their absence at a greater distance, favor this view. The shales and sandstone present a very regular bedding as exposed down the cañon. They finally become nearly vertical, then for some distance present a dip of 30° to 40° to the north, and are last seen resting against an older and greatly altered crystalline rock. Higher up on the sides of the cañon they rest on this ancient eruptive.

A mile back from the main cañon, on the south side and about 700 ft. above, is a remnant of the Miocene overlying the Cretaceous. The strata dip at a gentle angle to the northeast, and consist of light-colored, chalky, or calcareous rocks above, containing scattered and imperfect pectens, and at the bottom soft clays. There can be no doubt that these beds are unconformable on the Cretaceous, though no actual contact was observed.

The series underlying the Cretaceous appears for about 5 miles along the cañon, and consists of rocks of a greatly varied character. The first of the older, or pre-Cretaceous series, is a dark-green eruptive, seamed with epidote and so changed that the individual constituents cannot be made out with the unaided eye. This eruptive is succeeded down the cañon by other dark, fine-grained rocks, also evidently eruptive in origin. Below the eruptives on the rugged walls of the cañon are shown hard sandstones containing quartz veins, jasper, and serpentine. The last exposure consists of greatly contorted and crushed shales and sandstones filled with a network of minute quartz veins. The contact with the Cretaceous on the western border of the older rocks was not observed, but it appears a short distance away and continues for 2 miles down the cañon. The rocks of the latter formation consist of dark shales and gray sandstone dipping southwest at varying angles. They show no crushing or quartz-veining. The rest of the cañon to its mouth where it debouches on the Santa Maria Plain, is bordered by mountains of Miocene rocks, much disturbed and inclined at high angles. The contact with the Cretaceous was not plain, but it seems to be indicated by a conglomerate wholly unconsolidated, and which is followed a short distance down the cañon by the usual soft clays and sandstones of the Miocene. The conglomerate overlies the Cretaceous unconformably, has a distinctly reddish tint, and consists of angular sandstone fragments and well-worn pebbles. *Fig. 5* is a section along the road from Santa Maria to the Cuyama Valley, following the cañon most of the distance.

The geology of the region about the head of the Santa Ynez River is very complex, and though many new and interesting facts were noted, yet time did not permit of detailed work sufficient to illustrate the structure clearly or the relation of the various formations to each other. It was found, however, that there were extensive areas of the Chico, the Miocene, and smaller ones of the Lower Cretaceous. There can be no doubt that the main portion of the Santa Ynez range is Miocene, with a general anticlinal structure, well known in the San Marcos Pass. The center of the anticlinal is not generally the highest portion of the range, but lies on the eastern slope. The normal type of anticlinal structure is also masked by an east and west compression, producing features, however, of secondary importance. As viewed from the south at various points the range consists of heavy-bedded sandstone, dipping at a high angle to the south. The foothills and plain bordering the ocean, consisting of a higher portion of the same series, are mostly soft shales and clays,

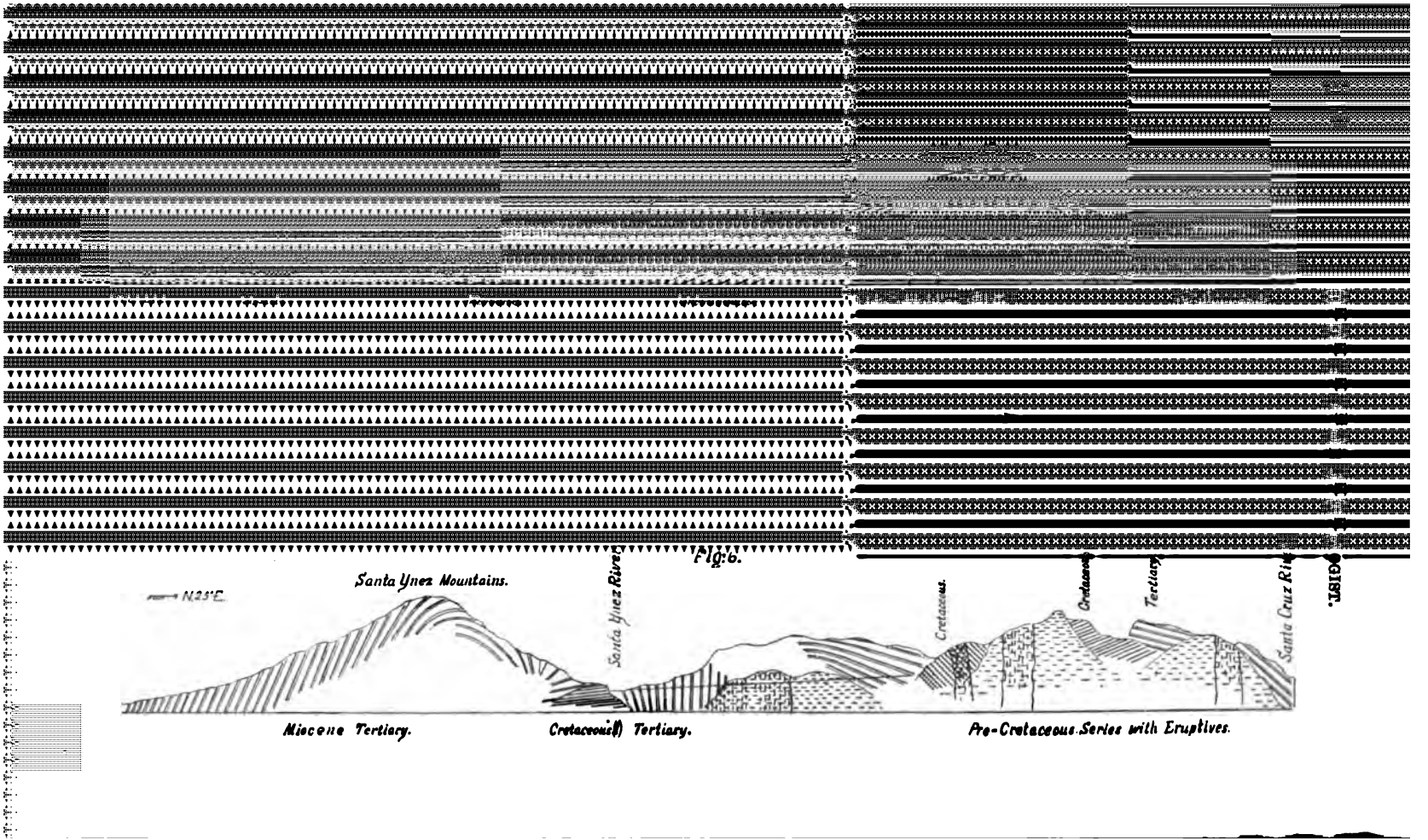

N.25°E.
Santa Ynez Mountains.
Santa Ynez River
Cretaceous.
Cretaceous
Tertiary
Santa Cruz Ri
Miocene Tertiary.
Cretaceous(?) Tertiary.
Pre-Cretaceous Series with Eruptives.

Fig. 6.

gradually becoming more flat as the ocean is approached. At the western end, in the vicinity of Point Arguello, no anticlinal structure is apparent, but steeply inclined and broken strata. Asphaltum is found in many places near the sea from Point Arguello to Ventura County. Antisell, in the report of the Pacific Railroad Survey, reported trachytic axes from many points in this range, but examination made it evident that he mistook areas in which the oil or asphaltum had been burned for eruptive bodies. There are numerous such areas in the vicinity of asphaltum deposits where the rock has been baked and partly fused.

The Santa Ynez River in its upper course runs close to the northern base of the Santa Ynez Mountains. On the north of the river rise quite abruptly the foothills of the San Rafael range. There is thus formed a rugged and narrow cañon where the formations are well shown. Several large cañons which come in from the north also give excellent opportunities for study. Beginning in Oso Cañon and extending in a slightly northwest direction for about 25 miles is an almost buried ridge of the pre-Cretaceous series. Nearly all the main tributary cañons of the Santa Ynez on the north cut across this ridge, which at its western end extends nearly to the summit of the San Rafael Mountains. As in the cañon of the Cuyama, this series consists of argillaceous rocks and sandstone greatly crushed, stratification being often nearly or quite obliterated, while silicification is more or less pronounced. Red jasper is the most striking rock present, and covers a considerable area. Serpentine, dark, fine-grained intrusives, and glaucophane schist also appear. On the sides of the older area are beds of black shale in which several intrusions of serpentine appear. Everything points to the fact that the serpentines all date from a time prior to that represented by the Chico. If this is a fact, then all rocks intruded by it must be at least as old as the Lower Cretaceous. Fossils indicating the Chico, or possibly the Lower Tejon, were found in strata apparently overlying those intruded by serpentine. The Miocene is very extensively developed. It consists of the bituminous slate series and sandstone, in some places but slightly disturbed, in others folded in with the Cretaceous. A great amount of faulting has taken place on both sides of this pre-Cretaceous axis, rendering the structural relations exceedingly difficult of elucidation. The notes here given make no pretense of accuracy in detail, but are intended to indicate what may be looked for. The scarcity of fossils in all the formations adds greatly to the difficulty.

The serpentine appears in places for 10 miles to the east of the last outcrop of the pre-Cretaceous axis. It is inclosed in black shale and limestone. In two spots it has been metamorphosed by mineral solutions with the deposit of cinnabar. Many years ago each of these localities was worked for that metal. At the lower mine, the Los Prietos, the river has cut through great cliffs of red gossan, which is inclosed in unaltered serpentine. In contact with the serpentine on the south is limestone; on the north, shale. The dip of both walls is nearly vertical at the contact. The appearances indicate that the north wall has been bent down toward the vein, while the south has been bent up. A half mile above, the shale, with thin beds of sandstone, appears in nearly vertical cliffs fully 1,000 ft. high, facing the river. In this great cliff, as well as for several miles up the river, whose general course follows the serpentine, the strata are crushed and broken. Several fossils were obtained from these rocks. They were determined as follows: *Turritella*

veatchi, Gabb; *Olivella mathewsoni*, Gabb; *Scalaria mathewsoni*, Gabb; *Axinea veatchi*, Gabb.

Four miles up the river is the Santa Cruz Mine, where the serpentine inclosed in black shale, outcrops nearly 600 ft. above the bottom of the valley. In Mono Cañon, a tributary from the north, a little to the east of the mine there is no appearance of the Chico. The rocks for a number of miles consist of the bituminous slate series of the Miocene. Between the two mines the river has eroded a channel across the strike of a body of Miocene sandstone exposing a perfect anticlinal arch. Terraces of bowlders and gravel appear nearly 500 ft. above the river at the Santa Cruz Mine.

A little above the point where the stage road over the San Marcos Pass strikes the river is another small outcrop of shales, supposed to be Cretaceous.

Fig. 6 is a section across the Santa Ynez range and through Red Rock Cañon. It is given particularly to illustrate the complicated structure shown in the latter cañon. In the lower portion of the cañon there are exposed three series of rocks: The pre-Cretaceous at the bottom, consisting of glaucophane schist and other altered eruptives, sandstone, and shale; resting on these are flinty beds of unknown age, and apparently unconformable, while on the top is the Miocene, forming an anticlinal over the submerged ridge of older rocks. These older rocks are well shown at the head of the cañon, where there is an immense outcrop of banded jasper, known as the Red Rock, rising vertically 300 ft. In direction of strike the jasper crops prominently to the east in Oso Cañon and to the west in many places for a number of miles. The older series contains in addition to jasper, sandstone, shale, glaucophane schist, serpentine, and other decomposed eruptives.

On both sides of the ridge between Red Rock Cañon and the Santa Cruz River are small exposures of black shale and thin-bedded sandstone, not greatly crushed, and very closely resembling the Lower Cretaceous, as it is generally known through the State. These rocks dip toward the center of the hill, which consists of the pre-Cretaceous. On the south the shales are exposed in a high cliff, and are full of nodular calcareous concretions. A dike of serpentine has been intruded into these shales conformably to the strike and dip. This is beautifully shown on the face of the cliff. Although no fossils were found, it seems highly probable that these unaltered strata belong to the Lower Cretaceous. The hills at the head of the cañon are capped by a Tertiary sandstone dipping north at a small angle. From the divide the deep cañon of the Santa Cruz is seen to head in very rugged mountains nearly 7,000 ft. high. Rocks apparently of Cretaceous age outcrop also in Oso Cañon. They dip nearly vertical, and are overlaid at the head of the cañon by a great thickness of Tertiary strata.

The Cretaceous and older rocks are again well exposed in Cachuma Cañon, which heads in the San Rafael Mountains north of the town of Santa Yñez. On the south the Tertiary clays dip into the range resting on the pre-Cretaceous series, which consists of jasper, sandstone, and shale with dikes of serpentine. The cañon cuts through this ridge of older rocks, then turns to the northwest, having eroded its channel along the contact between the Cretaceous and the basement rocks. The Cretaceous consists of black shales with some beds of sandstone, resting nearly vertically either against the basement rocks or the serpentine.

which has been intruded on the contact. Toward the head of the cañon the shales are filled with calcareous nodules resembling those in Red Rock Cañon. These rocks form the lowest part of the Cretaceous at this point, and may represent the Knoxville, as there is not much doubt about the intrusion of the serpentine into them. One of the tributaries of the Manzana heads opposite the head of Cachuma Cañon and flows northeasterly nearly at right angles to the strike. Following down this stream shales and sandstone are the only rocks to be seen for 3 miles. The dip is less than at the base of the series, being 50° to 60° northeast. About 2 miles down the cañon an ammonite was found, but in too bad a state of preservation to indicate anything more than the Cretaceous. These beds extend about half way from the divide to the Manzana, where they are replaced by vast beds of conglomerate formed of very smoothly rounded pebbles. The conglomerate has interbedded with it thin strata of shale and sandstone, and is undoubtedly a part of the Cretaceous. However, it dips considerably less than the underlying shales, but the exposures were not good enough to decide with certainty if an unconformity existed. The shales and sandstones have a thickness of as much as 8,000 ft., and the conglomerate several thousand more. The latter outcrop along the Manzana, and form the basal portions of the high mountains between it and the Sisquoc, the upper portions of which are formed of Miocene sandstone. In the upper part of Brown's Cañon, which heads several miles to the north of the Cachuma and empties into the Manzana, there are quite extensive dikes of basalt and serpentine intruded in the Cretaceous. The basalt is quite fresh and presents a variety of characters. It is present solely in the form of great dikes, and is said to extend several miles to the northwest. The crystalline rocks along this part of the San Rafael range are varied and of considerable interest.

The western half of Santa Barbara County, with the exception of a few small areas, is formed of middle or late Tertiary; the ranges of mountains between the parallel valleys which open to the northwest being Miocene, while the Pliocene is probably represented along the low hills bordering the level Quaternary valleys. The presence of large bodies of asphaltum and bituminous rock is very characteristic of the Miocene over much of this area.

The Santa Ynez Valley narrows about 10 miles below the old mission, and the river flows between Miocene hills until the Lompoc Valley is reached. On the south side of the river, where it leaves the Santa Ynez Valley, is a high, precipitous outcrop of volcanic tufa, and in the Miocene beds resting upon it are bowlders of a black basalt. Opposite Buell's ranch a cañon comes in from the Santa Ynez Mountains. In this cañon shales and sandstone of undoubted Cretaceous age show a width of more than a mile. They form an east and west line of hills bordering the Santa Ynez River for several miles. The shale alternates with thin layers of a dark sandstone and nodular calcareous strata similar to those seen in the supposed Lower Cretaceous in other portions of the county. The strata have undergone considerable crushing, and are in various positions; generally, however, they are quite flat, and toward the south have a southerly dip. A mile and a half up the cañon they are replaced by tawny, heavy-bedded sandstone, often showing no stratification. This sandstone forms all the higher country toward the Santa Ynez Mountains, and dips gently to the south and southwest. It contains poorly preserved specimens of *Pectens* and *Ostreas*. In a side

cañon which comes in from the west there is an excellent section showing the contact between the buff-colored sandstone and the dark shales. Both formations dip to the west, the sandstone 20° and the shale 3[illegible]. The non-conformity is very evident. The Cretaceous shales appear in only a few places along the road from the old mission to Gaviota, being almost completely covered by the Miocene. Heavy beds of bowlders of a serpentinous gabbro cap the hills west of the road about 3 miles south of the river. The large bowlders of coarsely crystalline gabbro, generally not much worn, are imbedded in a matrix of sand and small sandstone pebbles. It is not certain whether this is an old beach line or river bed. Associated with the large bowlders are small ones of jasper.

The Santa Ynez range at this point has a bold northern escarpment, rising over 1,500 ft. very abruptly. At the crossing of the river near the mission the sandstone dips northerly, while the high portion of the range dips to the south. There is here a rude anticlinal with an axis of Cretaceous rocks. The axis was not traced up the river on the south side, but it is probable that it appears in several places.

A short distance north of Lompoc Landing a reef of gabbro and serpentine extends out into the ocean for several miles.

Point Sal shows a bold face to the south and west. It consists of serpentine and other basic rocks. These extend for several miles, and are capped by Miocene clays and sandstone. The latter dip away from the crystalline axis, and are finely shown in the vicinity of the gypsum mines. Serpentine proper forms only a part of the crystalline rock, but is mixed in the most confused manner with gabbro and pyroxenic rocks, coarse to fine-grained, and quite variable as regards the relative abundance of the different components. Much of the serpentine is very fine-grained, and has inclosed bunches of all shapes and sizes of gabbro, and is, in addition, cut by dikes of the same. At times the boundaries between the two are sharp, at others there is a blending.

Dark, fine-grained eruptives outcrop through the Miocene on the summit of the ridge where the road to Santa Maria crosses it.

Another outcrop of the pre-Cretaceous series is to be seen on the Suey grant, north of the Santa Maria River. The formation seems to be the continuation of the ridge of rocks of the same age in the central part of Santa Barbara County. It consists of glaucophane schists and hard sandstone, and contains dikes of serpentine.

A series of ancient lavas begins on the ridge north of Fugler's Point, and extends in a northwest direction many miles, cropping on the western slope of the hills which border the Nipomo ranch on the north. Where the Cuyama road crosses this ridge the lava is a dark, fine-grained basalt. On the Nipomo ranch it has been much silicified by the action of hot springs now extinct. Agate-like chalcedonic nodules are abundant along the base of the hills for several miles. The basalt disappears 3 miles north of Nipomo, and a liparite much decomposed outcrops in places along the side of the valley nearly as far as Arroyo Grande. In places it is with difficulty distinguished from the Miocene sandstone. The line of ancient silicious springs was traced as far as Arroyo Grande. The silicification is not confined to the volcano rock, but appears also in the Miocene. The springs probably indicate an important fissure system, which may be traced northwest to Morro Bay by the numerous bodies of acid eruptives. Near Arroyo Grande the bituminous slate series has been mineralized with the deposit of iron pyrites, leading to a useless

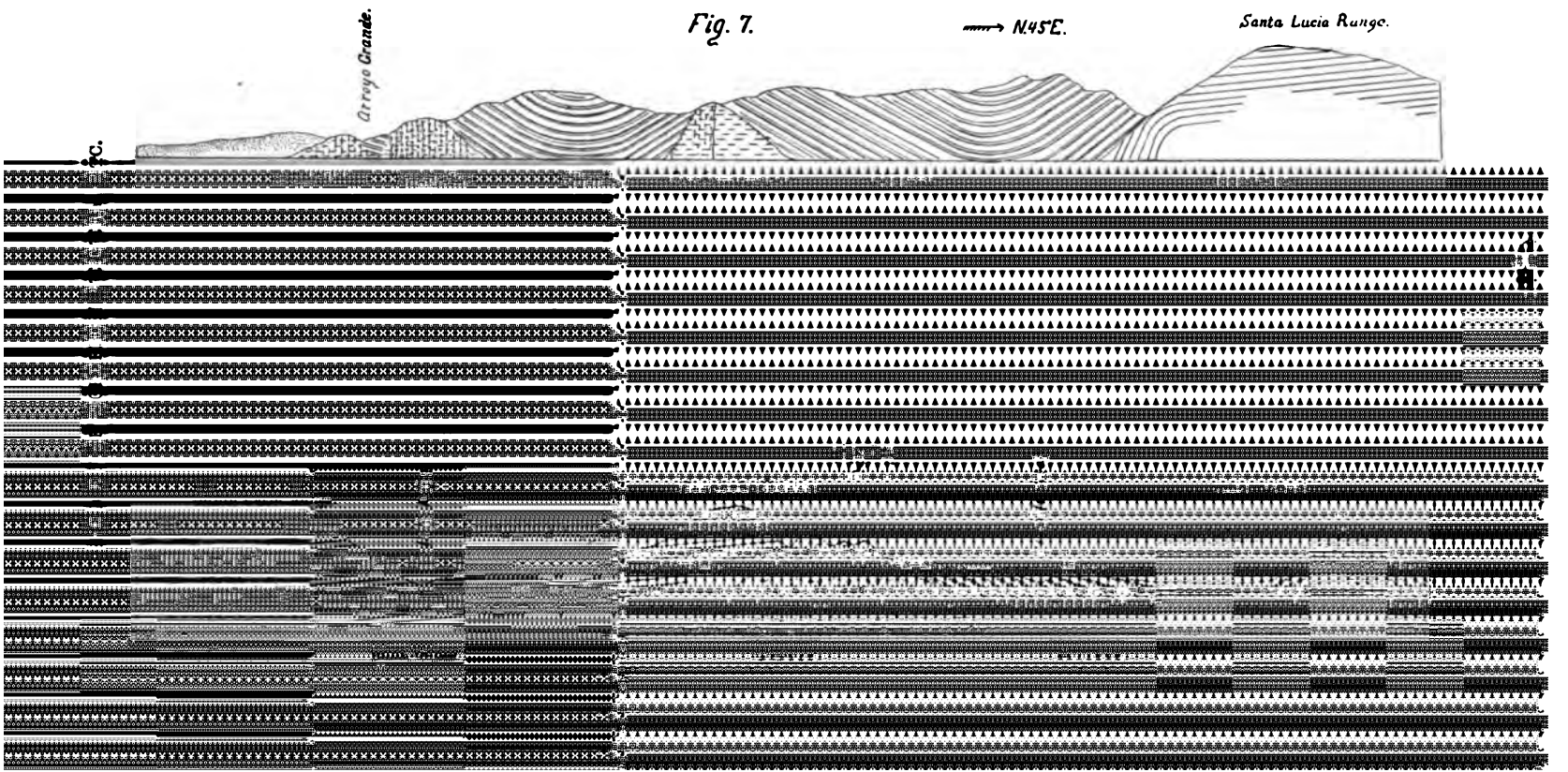


Fig. 7.

search for the precious metals. A small outcrop of serpentine appears south of Arroyo Grande near Los Barros Creek. As we proceed up the Arroyo Grande it is noticed that the Miocene forms a synclinal, dipping from the liparite on the southwest and on the north from serpentine, jasper, and sandstone, which outcrop on Tar Spring Creek. Before reaching the serpentine, high cliffs of a fine-grained liparite appear rising through the Miocene on the south bank of the creek. Liparite also outcrops on the Arroyo Grande about 5 miles above the mouth of Tar Spring Creek. Still farther up the Arroyo Grande it is found that for several miles the Miocene dips to the northeast, but before reaching Music it changes to the southwest, forming a synclinal, and consists of heavy beds of granitic sandrock bearing numerous fossils of the gigantic fossil *Ostrea*. Lower in the series these beds are replaced by argillaceous rocks, and on the Wasno, just over the divide from the head of the Arroyo Grande, the Miocene terminates in soft, white sandstone with very heavy bedding, and dipping southwest at an angle of 45°. A few feet away on the opposite side of the creek appeared the Chico, consisting of coarse-yellow to gray sandstone, conglomerates, and some shale. The beds dip at an angle of about 80° to the southwest. The actual contact was not observed. *Fig. 7* is a section from the ocean up the Arroyo Grande to the summit of the Santa Lucia range.

The Chico forms the southern portion of the Santa Lucia range as far north as the Rinconada Quicksilver Mine. The main part of the series consists of coarse sandstone and conglomerate, dipping very regularly at a small angle to the southwest. The dip becomes greater as it disappears underneath the Miocene on the Wasno. North of the Rinconada Mine it is gradually replaced by the Miocene, and continues to form only the northeastern slope of the mountains facing the Santa Margarita Valley.

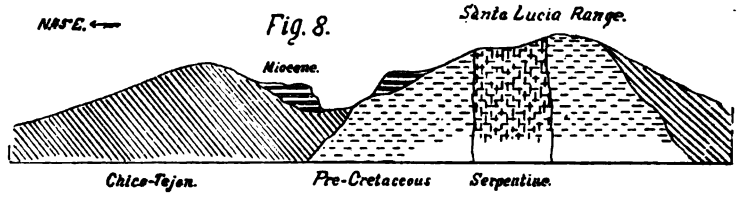


Fig. 8 shows a section of the Santa Lucia range near the Rinconada Mine. On the summit, southwest of Poso, where the trail crosses the Wasno, serpentine and the pre-Cretaceous sandstone and jasper outcrop in a long narrow exposure, with the Chico rising somewhat higher on either side. The younger series shows no disturbance. The older rocks become more prominent to the northwest, and at the Rinconada Mine are a mile wide, and consist largely of serpentine. Beyond this the older rocks become less prominent, occupying only a narrow strip through the foothills of the Santa Lucia range nearly to Santa Margarita Station. Four miles southwest of the town a deep cañon was examined, in which it appeared that the bituminous slate series (Miocene) had taken possession of the whole range, dipping 60° S.W., strike N. 40° W. The slates show the best cleavage of any seen in the Tertiary. The upper foothills are formed of heavy-bedded sandstone and black shale, in which fossiliferous limestone nodules were found. All the fossils were of one species,

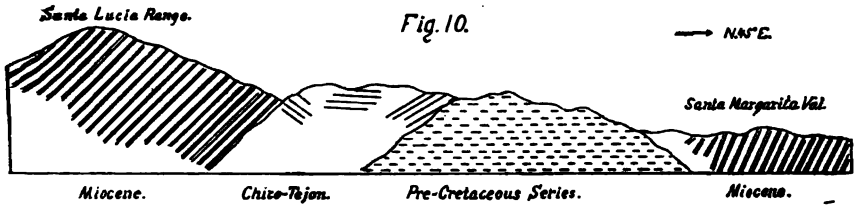


Fig. 10.

namely, *Venus lenticularis*, Gabb. This formation then belongs to the Chico. About 5 miles up the Santa Margarita Valley, on the same range, the following species were found: *Trigonia evansi*, Meek; *Axinea veatchi*, Gabb. These also indicate the Chico. *Fig. 10* shows a cross-section of the range for 4 miles south of Santa Margarita.

South of Santa Margarita the pre-Cretaceous series consists of hard-jointed sandstone and jasper. Eastward in the bottom of the valley the Miocene shales again appear, dipping at a high angle to the southwest. As the valley is crossed in the direction of the Salinas River, coarse, loosely cemented sandstones, carrying *Ostrea titan*, replace the slate, and are in turn followed by granite near the river. The stratigraphical relation of the *Ostrea*-bearing sandstone to the bituminous slates is not certainly known; it would appear, however, from the section on the Arroyo Grande that the sandstones are below.

The granite occupies a considerable area of bushy hill country north of the river, and a few miles to the southeast rises in the high San Luis range. This range is bordered on the south between Santa Margarita and Poso by hills of white Miocene sandstone. The road from Poso to La Panza passes over granite nearly the whole of the distance. The summit of the range where the road crosses has an elevation of 2,700 ft. A large part of the crystalline rocks of this range contain much glassy feldspar, and some portions are porphyritic. Dikes of a fine-grained granite with flesh-tinted feldspar are abundant, particularly on the western slope. They vary from a few inches to many feet in width, ramifying in all directions in the coarse granite. Titanite in small yellow crystals is abundant in the main body of the granite. On the eastern slope, 6 miles from La Panza, a body of limestone is inclosed in the granite. The granite crosses the range diagonally, extending in a more easterly direction. At La Panza the outcrop is much narrower, and on the San Juan Creek, 4 miles below the Carisa ranch house, it disappears. The formation replacing the granite in the southern portion of the range is a series of conglomerates and sandstone of great thickness, and dipping southwest at a low angle. These connect with the Cuyama and Santa Lucia ranges at the head of the San Luis Valley, and are undoubtedly a portion of the Chico. These beds do not extend much east of the head of the San Juan Creek, though the exact demarcation between them and the Miocene has not been traced out. The Carisa Plain is bordered wholly by rocks of Tertiary age. The Mount Diablo range on the east has an elevation of 3,300 ft. at the Temblor Pass. In the pass a sort of anticlinal structure was noted, but the mass of the range at this point seems to be a monoclinal, with dip to the northeast. As La Panza is approached from the Carisa Plain the Tertiary assumes a northeast dip away from the granite, and is characterized by *Ostrea titan* and other Miocene fossils. The La Panza placers occur near the

junction of the Chico conglomerates with the granite, but whether the gold has been derived from them or from the granite has not yet been settled.

As far as is known, all the country drained by the lower San Juan is formed of middle and upper Tertiary.

Fig. 9 gives a section across the Santa Lucia, San Juan, and Mount Diablo ranges, on a line with Poso and La Panza.

Returning now to the coast and working north from Arroyo Grande we find another outcrop of trachyte a little north of Pismo. The region about Port Harford is rather an interesting one. A line of irregular Tertiary hills extends northwest from Arroyo Grande, lying west of the valley of San Luis Obispo. These are known in their western portion as the Buchon range. For several miles northwest from Arroyo Grande the Tertiary consists of soft sandrock impregnated with asphaltum over considerable areas. As exposed along the railroad to Port Harford, the strata consist of sandstone and bituminous slates in the form of a synclinal, dipping to the southwest from the older rocks west of Los Osos, and to the northeast from Port Harford. At the latter point the Tertiary appears resting on a complex of eruptives and crushed sandstone and jasper of the pre-Cretaceous series. From the dock to Whaler's Point the eruptives are very much decomposed. In a railroad cut a little to the east there appears a dike of somewhat fresher appearance, probably a diabase porphyrite. Irregular masses of serpentine appear in places crushed to a green clay.

The older series of sandstone, jasper, and slate, and intrusions of serpentine outcrop in small exposures on the western slope of the Santa Lucia and a little north of Arroyo Grande. Widening to the northwest this series forms the underlying rocks of the valley of San Luis Obispo as far as Morro Bay. It is also prominently developed in the hills on the eastern slope of the Buchon range. Serpentine forms the main crest of the Santa Lucia range for many miles to the northwest from the point where the old stage road crosses. The hills bordering the valley of San Luis Obispo on the west, from the point where the railroad to Port Harford cuts them, for several miles northward show large areas of serpentine. Large amounts of chromic iron have been taken from this region. The pre-Cretaceous rocks outcrop in the hills for 2 or 3 miles west of the serpentine near the head of Los Osos Creek. They consist of jasper, sandstone, and shale, with some intrusives of a dark, fine-grained character. *Fig. 11* represents a cross-section from Port Harford to the Salinas River, passing near the town of San Luis Obispo.

The line of buttes extending northwest from San Luis Obispo to Morro Bay is one of the most striking features in the topography of the county. The buttes consist of liparite, which is quite uniform in texture and composition. Two small buttes rise out of the valley southeast of the town of San Luis Obispo, but the lofty and precipitous ones all lie between the town and Morro Bay. The liparite rests on serpentine, as well as on the pre-Cretaceous series, thus showing it to be younger. It is quite possible that the material of each butte may have had a separate source, for now, at least, they are all separated from each other by depressions almost as low as the valley itself. The rock in these depressions belongs to the pre-Cretaceous series. The altitude of the main peaks varies from 1,500 to 2,000 ft., with a thickness of liparite of perhaps 1,000 ft. For several feet from the surface the rock

Fig 11.

is discolored and decomposed, the original color being a gray. Morro Rock, the most northern of these buttes, is a bare mass rising about 600 ft. above the ocean. A quarry has been opened at the eastern end to supply material for the breakwater at Port Harford. Excellent specimens of fresh rock were obtained here, containing quite a sprinkling of small titanite crystals. The rock would make a good building-stone if it did not discolor on exposure.

The pass through which the road runs from San Luis Obispo to Santa Margarita divides the Santa Lucia geologically. On the southeast the Tertiary forms the crest of the range for several miles. On the northwest serpentine forms the crest and western slope. The eastern slope consists of black shale, judged to be Lower Cretaceous, because of the presence in it of a stratum rich in fossils of the genus *Aucella*. The black shale is seen first in the cañon southeast of the railroad tunnel. The tunnel cuts it for 600 ft., while the rest of the rock passed through is serpentine of varying character. The new railroad cuts have exposed some interesting tufa-like rocks of volcanic origin on the northern slope of the range. From this point down the creek to Santa Margarita the Chico sandstones outcrop. They continue to be very extensively developed on the northeastern slope of the range for many miles to the northwest. In fact, future examination showed that they were almost continuous to the head of the Arroyo Seco, in the western part of Monterey County. Five miles west of Santa Margarita the dark Cretaceous shales have a width of nearly a mile. On a trail which crosses this shale and leads up to the old Padre Mine, there is exposed a stratum at least 10 ft. thick, filled with rather poorly preserved specimens of the genus *Aucella*. The strata dip into the mountain at a small angle. The shales do not come into direct contact with the serpentine at this point, but are separated by a dike of diabase. They are considerably metamorphosed near the diabase, while a narrow stratum between the diabase and the serpentine is very much changed. The shales extend across the range on the head of the creek, and later investigations showed that they reached as far north as the head of Toro Creek, keeping near the summit of the range. The Cretaceous rocks outcrop in a direction at right angles to the strike across the creek below the old Padre Mine and part way up a high mountain on the northeast. In this direction strata are exposed which are lower in the formation, and are filled with calcareous nodules similar to those seen in the shale in several localities in Santa Barbara County. This mountain is quite precipitous to the south, and on the summit occur rocks of quite a different character. These rocks much resemble the Tertiary, though no fossils were found. Between the two formations a horizontal body of lava has been intruded in the form of a laccolite. The Cretaceous shales below are much broken for half a mile away, and for 200 ft. considerably baked, presenting bluish and greenish tints. The younger rocks above are also greatly broken, dipping in every direction, and the banded sandstone strata in near contact with the eruptive, show red, brown, and greenish tints. It seems probable that some of the shales directly below are also Tertiary. The lava is about 50 ft. thick in the center, thinning out at the extremities. It is quite porous on the edges and in narrow bands running horizontally through it, the pores being filled with calcite. Large crystals of feldspar appear in places in the dark, fine-grained rock.

The area of serpentine in the Santa Lucia, north of San Luis Obispo,

is very great, forming nearly the whole of the western slope of the range from the railroad tunnel northwest to Cayucos. It contains many chromic iron deposits, and is characterized by numerous bodies of diorite, generally in nodular form and from 2 to 3 ft. in diameter upwards.

The Miocene increases from small areas in the foothills of the range east of Morro, until back of Cayucos, near the summit of the range, where it is a mile and a half wide.

Toro Creek, which enters the ocean between Morro and Cayucos, was ascended to its head, and another complete section of the Santa Lucia range was made. For the first 6 miles up the creek the only rocks seen belonged to the pre-Cretaceous series, consisting chiefly of sandstone and jasper. At the base of the first high range, which consists of serpentine, there is a small area of Miocene. Northeast of the serpentine range, through which the stream has cut a narrow gorge, is a trough about 2 miles wide filled with black shale and a little sandstone, dipping northeast at a small angle. In one of the beds of coarse sandstone were found large, excellent specimens of *Aucella*. They occurred, perhaps, a thousand feet from the exposed base of the shales. Northeast of this Cretaceous valley is another range of serpentine, diorite, sandstone, and jasper. On the northeast slope rest heavy-bedded sandstones, probably of Chico age. These dip northeast at an angle of 40°. At the foot of the mountains the sandstone is followed by nearly horizontal Miocene strata, bituminous slates extending easterly to the Salinas River. Small patches of Miocene also appear near the summit of the eastern crest of the range just described. *Fig. 12* gives a section of the mountains at this point.

Between Templeton and Cayucos, a section farther north, no Lower Cretaceous strata appear, while Miocene shales are strongly developed on the west, extending up to and forming the crest of the range. The dip is to the southwest at a high angle. A dike of diabase, at present very much decomposed, has been intruded in them below the summit on the western slope. The summit of the mountains is broad here with a rolling surface, while here and there the pre-Cretaceous rocks project up through the Tertiary. The Chico extends up to the summit on the east. Everything points to the fact of the intrusion of the serpentine prior to the deposition of the Chico. The altitude of the range at the two cross-sections just given is about 1,400 ft.

With the exception of a small area of Miocene at Point San Simeon, and of Cretaceous south of Cambria, the rocks of the pre-Cretaceous series with decomposed eruptives form the coast-line for many miles north from Morro Bay. The greater portion of this older series consists of sandstone. It is not a very quartzose rock, and in decay produces a heavy soil. Beds of shale or slate appear interbedded with the sandstone. Jasper is not abundant along the coast, but in the higher ranges is very characteristic. There are several classes of eruptives. One has a greenish-gray or brownish tint, is fine-grained, and greatly decomposed. These rocks appear near Cayucos, between Cambria and San Simeon, and at various other points along the coast. There are numerous outcrops of serpentine near the coast, but the areas of greatest extent are found higher up in the range. Liparite quite similar to that at Morro Bay outcrops on Santa Rosa Creek north of Cambria, near the summit of the range 6 miles east of Cambria, on San Simeon Creek a mile from the ocean, and at several other places in the vicinity of

Cambria. It also forms a number of rugged peaks on the summit of the Santa Lucia. The highest of these peaks lies back of San Simeon and is known as Pine Mountain. The liparite is undoubtedly the youngest of the eruptives in this region.

The strike of the pre-Cretaceous series is irregular—from Morro to San Simeon perhaps more often east and west, though sometimes parallel to the coast; dip generally slight. North of San Simeon the strike runs parallel to the coast and the dip is to the northeast at a small angle. Only a slight metamorphism is shown. The argillaceous rocks, which if not for the crushing undergone would be present as slate, are either represented by shale or clay. When the mechanical forces have been particularly strong the sandstone strata have been crushed and the shale, or rather clay, has been squeezed around the fragments so as to envelop them.

A belt of Miocene slates begins at Point San Simeon and extends northwest. It gradually passes away from the coast, forming low hills between the more mountainous portions of the Piedra Blanca grant and the ocean. It terminates in scattered patches 14 miles northwest of San Simeon, near San Corpojoro Creek. At San Simeon it dips oceanward at a high angle. Another cross-section of the mountains was made between Cambria and Paso Robles. Five miles east of Cambria the creek has cut through a dike of feldspar porphyry, leaving high cliffs on either side. Eight miles east the Miocene appears capping the hills. This strip of Tertiary continues northwest as far as the southern portion of the Piedra Blanca grant, and in a southeast direction connects with the great body of rocks of the same age on the summit back of Cayucos. The thickness of the strata is not great east of Cambria, and it seems strange that this section should have been selected as a suitable place to bore for oil. Eight miles east of Cambria, near Mr. Lehman's place, a well was put down nearly 700 ft., when a crystalline rock was encountered. The Tertiary rocks here are much disturbed by dikes of diabase, and it is probable that one of these was struck. This diabase is well exposed in a cañon near the Oceanic Quicksilver Mine. Four dikes of very greatly decomposed rock appear as intrusive in the Miocene. The strata have been thrown into a vertical position and considerably metamorphosed. Two of the dikes are each nearly 300 ft. wide. At the foot of the grade on the head of Santa Rosa Creek these dikes were encountered again. Here they are more decomposed still, with the development of a concentric shell structure. The nodules are, many of them, a foot in diameter, with very even, regular shells a quarter of an inch thick.

The usual series of shales, sandstone, and jasper forms the main portion of the Santa Lucia at this point. Patches of Tertiary extend up nearly to the summit on the southwest, while beginning only a short distance down on the northeast, the Chico sandstone and shale have a width of several miles. Below them is a lesser range of the older rocks, in which the Santa Cruz Quicksilver Mine is situated. East of this the Miocene slates underlie the whole country, except for a submerged axis of granite through the Salinas Valley. This granite axis is the prolongation of the crystalline axis of the San José range. It appears in places from Paso Robles northwestward along the divide between the Nacimiento and San Antonio rivers, finally joining with the more rugged portion of the Santa Lucia. The Miocene is almost undisturbed except on its very western

edge, as shown along the road from the Santa Cruz Quicksilver Mine to Paso Robles. Near the granite it changes to a loose quartzose sandrock. The course of the hidden granite axis can be traced by this sandrock.

A shaft was sunk for coal near the mouth of San Simeon Creek many years ago. Thin seams only were found and the work was given up. The coal is found in rocks which are supposed to belong to the pre-Cretaceous series, and it is the first instance which has come to the writer's attention of coal in that series of rocks in California. The low hills along Pico Creek are capped with a soft rock, probably Miocene. Near the head of the creek on the southeastern side of the Piedra Blanca grant there is a considerable thickness of a rather soft sandstone of unknown age, in which a small seam of coal has been found. The summit of Pine Mountain, as before stated, consists of liparite. Around its borders and apparently underlying it is a body of black shale, dipping to the northeast. The liparite is several hundred feet in thickness, and was once much more extensive. The underlying shale being soft, was worn rapidly away and the liparite has broken off in large masses, which strew the mountain sides and are piled in the cañons fully a mile away. On the grade leading up to the old sawmill specimens of *Aucella* have been picked up, and one is in the possession of the Mining Bureau. This gives the age of the shales as Lower Cretaceous. Serpentine apparently cuts the shale, but that could not be stated definitely, for no good contacts were seen. *Fig. 13* is a section of the Santa Lucia through Pine Mountain. From this point northward the Santa Lucia range has an elevation of fully 3,000 ft., and is very wild and rugged. North of San Simeon the range approaches the ocean, and north of San Corpojoro Creek but little agricultural land is to be found. The high mountains closely border the coast all the way from this point to Monterey, much of the distance rising very precipitously. But few small patches of land sufficiently level to be cultivated exist. Most of the mountain slopes facing the ocean are free from brush and are used as grazing land. A rough trail follows up the coast, and owing to the numerous deep cañons which it has to cross, is an exceedingly difficult and somewhat dangerous one to travel.

The pre-Cretaceous series, though it becomes more metamorphosed in portions of this lofty region, contains in general few intrusive masses. It is characterized by more or less silicification, and in the west central portion of the county (the Cruikshank District) the quartz veins are numerous and often rich in gold. However, it may be remarked that the gold-bearing quartz veins are not confined to this district, but from the center of Santa Barbara County northward through the whole length of the coast ranges, wherever this formation occurs there is more or less silicification, and at numerous points quartz veins carrying iron sulphides and traces of gold are to be found. In the cañon of Salmon Creek 3 miles above its mouth much prospecting has been carried on. The veins occur in a rather broken rock consisting of sandstone and shale. About half a mile south of these prospects, on the divide between the two forks of Salmon Creek, there is exposed the most remarkable bed of slates yet seen in this part of the coast ranges. The belt extends easterly, it is reported, for several miles. The dip is north away from a great serpentine ridge. The slates cleave well and have evidently escaped the effects of crushing which is so generally to be seen. In the shining black appearance and manner of weathering they closely

Fig. 13.

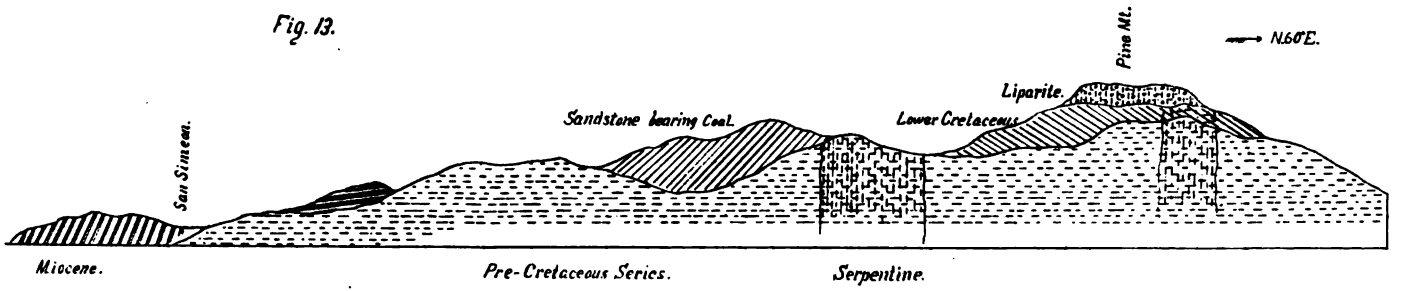


Fig. 14.

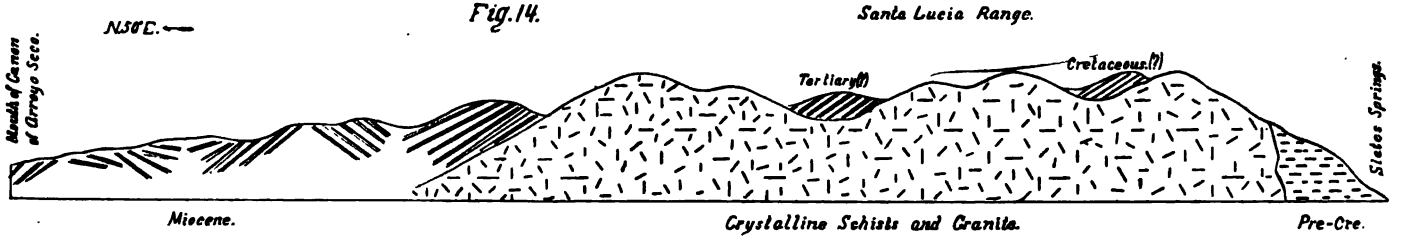
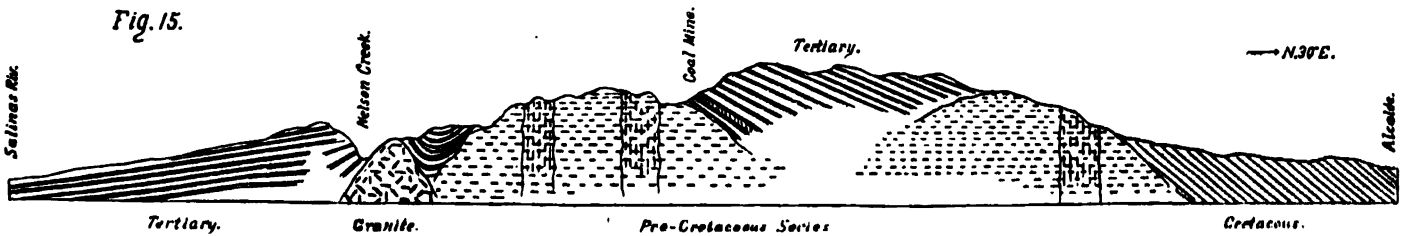


Fig. 15.



resemble the Mariposa slates along the Mother Lode. Time did not permit of the search for fossils in this slate, but the chances for finding them here are much better than in most of the argillaceous rocks which have been so much distorted. The serpentine on the south contains many great bunch-like masses of diorite. Dark, fine-grained eruptives of various kinds outcrop in the cañon of Salmon Creek.

From Salmon Creek to the Cruikshank ranch the trail follows in the strike of the rocks, the shales and sandstones dipping generally to the northeast. The Cruikshank Mines lie at an altitude of about 2,700 ft., nearly on the summit of the range. No intrusions of any kind are to be found near the mines. The formation is sandstone chiefly, with some shale, and is very much broken. About 2 miles west of the mines the mountains rise somewhat higher and very precipitously from Point Gordo. Here is a considerable outcrop of a decomposed amygdaloidal lava, the region being known locally as the "Volcano." The lavas were traced for several miles to the southeast past the Cruikshank ranch. Two miles south of Pacific Valley a heavy body of serpentine forms a bold projection into the ocean. From Pacific Valley north to Mill Creek the trail follows near the ocean. The rocks are much metamorphosed and contorted, beautifully banded jasper appears, as well as semi-crystalline schists and sandstones, which are crumpled and filled with quartz veinlets in a manner quite similar to the rocks along the summit of the coast ranges in the western part of Tehama County. From the Cruikshank Mines the trail leads eastward to the Newhall ranch and Jolon. The pre-Cretaceous series has a width of 10 miles. The only eruptives seen on this trail were a dike of serpentine and a small one of glaucophane schist. Sandstone, shale, and jasper form the prevailing rocks. The last ridge, bordering the Nacimiento on the west, consists of the Chico dipping to the northeast. The basal portion rests on the pre-Cretaceous series. It is a coarse, feldspathic sandstone, followed upwards by shales, sandstone, and conglomerates. The sandstone dips under the valley of the Nacimiento and rises again on the eastern slope of the hills between it and the San Antonio River, dipping from these hills to the southwest. The river thus flows in a synclinal, which becomes very narrow at the upper end of the Newhall ranch, where the river issues from the cañon. This sandstone appears for several miles up the cañon, finally giving place to crystalline schists, which from this point northwestward form the main part of the Santa Lucia range. This is not, however, the most northerly point reached by this Cretaceous arm, for it forms much of the very rugged country on the head of the San Antonio, extending over the divide between it and the Arroyo Seco, and outcrops at least as far north as the point where the trail crosses the range from Slate's Hot Springs to the Arroyo Seco. Fossils are reported from this latter locality. These Chico beds are not known to extend over onto the ocean slope of the range.

The submerged granite ridge extending northwest from Paso Robles crops out on San Marcos Creek, 6 miles southwest of San Miguel, at several points between this locality and Pleyto, and again between the Newhall ranch and Jolon. Northeast of the latter point this granite axis rises to form with crystalline schists the main portion of the Santa Lucia range. The schists replace the granite north of the Newhall ranch, and with limestone form the high mountain about the head of the Nacimiento. Over the divide they extend about half way down to

the ocean, where they are replaced by rocks of the pre-Cretaceous series. As exposed along Vicente Creek, this latter series rests unaltered against the crystalline complex. The latter in this vicinity consists of mica, hornblende, and chloritic schists and quartzite, with many bodies of crystalline limestone. Dikes of granular character, consisting of quartz and feldspar, also those of very coarse hornblende and feldspar, with others of a more basic character abound. The pre-Cretaceous rocks near the contact are crushed and filled with quartz veins. The limestone is very highly crystalline, and in many places is characterized by the presence of molybdenite, pyroxene, and a golden-colored mica. Garnets are very abundant in the schists in this portion of the Santa Lucia. The limestone increases in amount toward the northwest, and on Mill Creek is enormously developed. It extends from the summit of the mountains at an elevation of 4,000 ft. down Mill Creek to within half a mile of the ocean. It is often interstratified in the schists in bodies of no great size, but beds apparently several thousand feet in thickness appear in the higher portion of the range. They apparently extend through a vertical distance of many thousand feet of schists. Mountain movements have subjected the rocks to such strain that the limestone beds are broken into innumerable fragments, so that in getting out rock for the Rockland Lime Company, whose limekilns are located on Mill Creek, no solid unbroken beds could be found. The whole side of the cañon appears to be formed of a loose aggregate of angular limestone fragments. The limestone beds lie in the form of a V, extending down nearly to the ocean on the South Fork of Mill Creek, and retreating again to the summit of the mountains in the direction of the head of the North Fork. The limestone appears in enormous masses on the summit east of Big Cañon. They were examined nearly to Hot Springs Creek, and are reported to extend northward as far as Pico Blanco, a prominent mountain back of the Sur. The limestone is everywhere exceedingly metamorphosed, and though examined carefully in many places not a trace of life was detected.

Considerable metamorphosed rocks of various kinds, together with decomposed eruptives, outcrop along the ocean near the mouth of Mill Creek. It was not determined certainly to which series of rocks they belonged. The crystalline schists retreat toward the higher mountains north of Mill Creek, and there is a corresponding expansion of the pre-Cretaceous series, sandstone, including dikes of serpentine, appearing nearly half way to the summit. It was noticed that without exception the eruptives characteristic of the pre-Cretaceous series do not appear in the crystalline rocks, although it would seem in places that the eruptive must be intrusive in them below the surface. South of Big Cañon the sandstones of the older series were seen resting on the granular chloritic schists without exhibiting any metamorphism, thus demonstrating conclusively the great break between the two formations. Except for two small outcrops of limestone north of Salmon Creek, none was seen in the pre-Cretaceous series in this part of the State, while the limestones of the crystalline complex were seen to extend up to the contact and no farther. South of Big Cañon, and between the pre-Cretaceous series and the coast, is a strip of dioritic rocks through which the creek has cut a deep and narrow gorge. On the north fork of the creek, below Dolan's Hot Springs, occur serpentine shales and sandstones, and above them the granitic rocks.

From Big Cañon the narrow strip of pre-Cretaceous extends up the coast to and past Slate's Hot Springs. In fact, the series is reported to reach as far north as Point Sur. The strip is less than a mile wide, and consists of shales, sandstone, and jasper. The series terminates at the base by a conglomerate resting against the crystalline schists. The dip is either a very steep one away from the range, or, as it is in places, into the range. The conglomerate has a thickness of several hundred feet, but its extent along the coast was not traced out. The bowlders are all smoothly washed, and the most of them consist of a chloritic granite or gneiss similar to that in the mountains above them. The sandstone matrix is so metamorphosed as to very closely resemble a crystalline rock. At Slate's Springs the conglomerate is followed upward by sandstone, slaty shale, and jasper. The whole series is considerably metamorphosed, and all the members filled with ramifying quartz veinlets. The shale in its metamorphism has assumed the appearance of a fine-grained mica schist. Fragments of a fossil shell belonging to the genus *Inoceramus* were found in the cliffs at the hot springs. The specimens were, however, very poorly preserved, on account of the shaly nature of the inclosing rock, and nothing definite could be made out about them. The basal conglomerate settles conclusively the greater age of the crystalline schists, and probably of the granite also. In addition to the coarse, fresh-looking granite and gneiss of the Santa Lucia range, there are large bodies of granitic rocks with a chloritic constituent in the place of the mica, and which are probably much older.

A very interesting thing in connection with the study of the crystalline schists and the pre-Cretaceous series resting on them, is the fact that not the least sign of the contact is noticeable from a study of the topography. In fact, the whole Santa Lucia range is an anomaly in this regard. The range is unbroken by any low passes indicative of the changing formations. The change in topography from Tertiary to Cretaceous, and from Cretaceous to pre-Cretaceous, is only slightly noticeable, while the pre-Cretaceous laps onto the crystalline schists, gradually thinning out toward the north.

The San Antonio Valley is separated from the Salinas by a line of Miocene hills known as the San Antonio Hills. Rocks of the same age also close in the valley on the north, forming the foothills of the Santa Lucia Peak. Six miles above the old mission the San Antonio River cuts through a ridge of crystalline rocks, above which another small valley opens out, having on its northern side extensive Miocene shales. The whole of the Miocene, as far as was noticed in this section, dips to the northeast at an angle of about 45°. The last great elevation seems to have been to the southwest.

The Arroyo Seco is a large stream which cuts nearly across the Santa Lucia range. Miocene rocks are the only ones exposed for about 10 miles above the mouth of the cañon. They are folded together and contorted into every conceivable position. At Abbotts the last of the Tertiary is seen resting on the crystalline schists. The latter consist of mica and hornblende schists, varying to gneiss, and intersected very generally by veins of granitic matter. From this point to the summit there is very little variation in the character of the rocks. In places they become almost granitoid. Portions, at least, of San Lucia Peak, the highest mountain in the range, are formed of the coarse white porphyritic granite like that at Monterey. Beginning on the Arroyo Seco,

about 3 miles below the Tassajara Springs, sandstone of supposed Tertiary age is exposed in a long shallow deposit extending several miles to the northwest. It dips about 40° to the northeast.

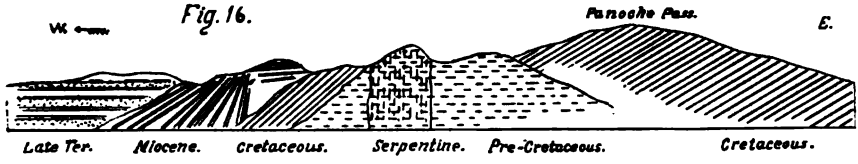
North of the Arroyo Seco the eastern portion of this mountainous region is known as the Soledad Hills. They form a very high and regular mountain wall on the western side of the Salinas Valley for about 25 miles. They are separated from the main portion of the Santa Lucia by the valleys of the upper Carmel River. This range of hills has an elevation of 2,500 ft., and consists of crystalline schists, with occasional bodies of limestone. The Miocene slates extend over the divide from the Arroyo Seco to the Tularcitos, forming the valley of that stream down to its junction with the Carmel, and finally connects with hills of the same age east of Monterey. Mount Toro, at the northern end of the Soledad Hills, shows a considerable body of granite, while the crystalline schists in the region about are filled with granitic dikes. *Fig. 14* gives a section through the Santa Lucia in the region of the Arroyo Seco.

Between Paso Robles and the southern Cholame Valley undisturbed beds of late Tertiary age appear. It is on the east of this valley that the pre-Cretaceous axis of the Mount Diablo range first appears. The pre-Cretaceous series gradually rises from beneath the Tertiary north of Polonio Pass, and forms a ridge of 3,000 ft. elevation north of Parkfield. The Tertiary rises high on both sides, in places capping it, as in the region about the head of Stone's Cañon. The characteristic rocks of the older series are all well represented in this range. They consist of sandstone, shale, and jasper, with eruptives, among which are serpentine and glaucophane schist. The Cholame Valley is bordered on the southwest by Miocene hills. In the edge of the valley, at the base of these hills, is an outcrop of granite, which has been so crushed and decomposed that it can hardly be distinguished from the granitic sandstones adjoining. The granite does not appear prominent, but its position is indicated by a series of soft sandhills extending to the head of the valley. Granite associated with limestone outcrops along Nelson Creek for 2 miles. Both the limestone and granite have been brecciated and the fragments re-cemented. The overlying formation is a soft gypsum-bearing clay, followed down Indian Creek by sandstone and the typical bituminous slate series. Above the Tertiary clays, which are in contact with the granite on the east, rises the main range. On its western slope are large areas of typical banded jasper, showing a fine, wavy structure. The summit is capped by Miocene sandstone and shale, dipping to the northeast at a high angle, and containing the Slack Cañon coal beds. As we descend the northeastern slope from an elevation of 3,500 ft. the pre-Cretaceous series is again encountered and continue down to Carey Creek. Walton Cañon has a length of 6 miles, giving an excellent exposure of sandstone and shale of probable Cretaceous age. The strata dip easterly at an average angle of 50°, exposing a thickness of nearly 20,000 ft. *Fig. 15* gives a section of the range at this point.

A great thickness of similar strata appears south of Los Gatos Creek. The pre-Cretaceous series outcrops quite prominently on the southern end of the range of which San Carlos is the dominating peak. It also appears in the mountains along the eastern side of the upper San Benito. West of the river the formation is chiefly Tertiary; farther down

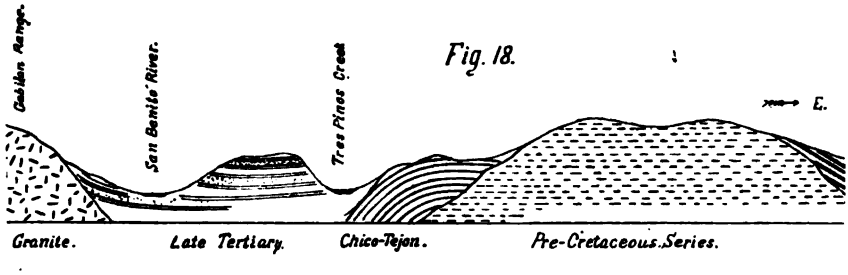
the river cuts through the high range, of which Hepsedam is the culminating peak. The axial rocks of this range belong to the pre-Cretaceous series. Below the point where the river cuts through this range, the flanking hills are all Tertiary. They rise in places in bold cliffs facing the river.

West of New Idria is one of the largest areas of serpentine known in the coast ranges. The features which its surface presents are quite



unusual. Owing to some peculiar manner of decomposition the surface has been so softened that it appears in the form of rounded clay hills, often entirely free from vegetation of any kind. Rising out of these hills are occasionally to be seen mineralized portions carrying quicksilver. All the streams heading in these mountains are strongly impregnated with magnesia. Small areas of the pre-Cretaceous series appear about New Idria. To the east are barren hills in which the stratification of the Chico is very finely shown. The Chico appears well developed along the divide west of Panoche, the road to Tres Pinos crossing it for several miles. Lower down on the Tres Pinos Creek jasper and sandstone of the pre-Cretaceous series outcrops in a low ridge through which the creek runs in a cañon. The sandstones are crumpled and filled with quartz veinlets. Below these rocks is a small outcrop of dark shales, probably Cretaceous. In the hills on the sides of the cañon the Tertiary appears to rest unconformably on the dark shales. A short distance down the cañon the Tertiary has been folded in and stands almost vertically. The dip becomes less as we go down the cañon until it is almost horizontal. Beds of probable Pliocene age follow. The latter consist of but slightly cemented bowlder deposits, sandstone, etc., and have been eroded so as to give magnificent exposures.

Fig. 16 gives a diagramatic sketch of the mountains along the road from Panoche to the San Benito. In the region about the Los Muertos



grant the pre-Cretaceous series forms the summit and the western slope for 15 miles in the direction of Tres Pinos, when it becomes covered by sandstone of probably Chico age. A section across this range to the Gavilan is shown by *Fig. 18*. Going north from this point up

the Arroyo Joaquin Soto the older series disappears and its place is taken by high and rugged mountains on both sides of the valley, formed of liparite lying in nearly horizontal bands, and lesser amounts of more basic lavas. This volcanic country culminates in the San Juan Peaks over 3,000 ft. high. At this point the volcanic rocks have a width of 8 or 10 miles. They have a thickness as exposed in the mountains bordering the Joaquin Soto of fully 1,000 ft. The lava is exposed nearly to the foot of the grade on the road from Staytonville to Hollister. At its lowest exposures it is shown to rest on shales and sandstone probably belonging to the Chico. The antimony and quicksilver deposits about Staytonville occur in fissures in the liparite. It seems probable that the greatest thickness of the flow is as much as 1,500 ft. The variation in the lavas here makes this one of the most interesting regions in the coast ranges for the study of volcanic rocks.

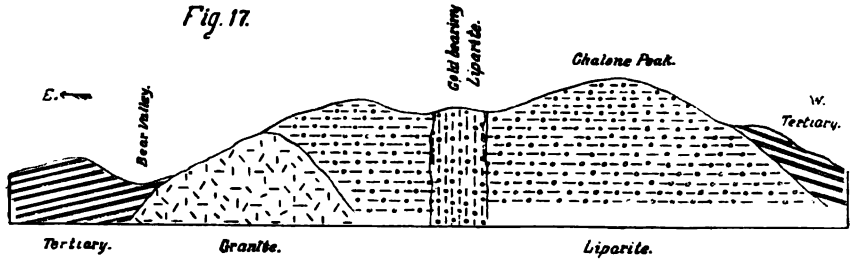
The Gavilan range is essentially a granitic one. It is evident that the granite on the west of Cholame Valley and in the cañon of Nelson Creek belongs to the southeast prolongation of this axis. This seems probable, not only from position, but from physical characters. Granite detritus is abundant in Slack's Cañon, while farther to the northwest there is another link, the granite outcropping prominently in the cañon of Lorenzo Creek, below Lone Oak. The greater portion of the latter exposure is a massive granite with glassy feldspars and small crystals of titanite. Granite appears again on Chalone Creek at the eastern base of the peaks, but the southern portion of the Gavilan range proper begins about 8 miles north of the peaks. Opposite Gonzales the granite has an exposed width of about 6 miles. The granite outcrops nearly to the base of the range on the Salinas side, while on the northeast, between it and the San Benito, are extensive Tertiary beds, consisting largely of granitic detritus, and extending in places nearly to the summit. As the range is followed northward the granite widens and, associated with crystalline limestone, extends down to the San Benito River, near Willow Creek. The limestone so prominent in this range crosses it slightly diagonally, beginning as just mentioned on the eastern slope near Willow Creek; the beds extend to and over the highest portion, Fremont Peak, and down on the western side. The beds are not continuous, but appear as kidney-shaped bodies. They vary from coarse to finely crystalline. The limestone, though fully as much metamorphosed as that in the Santa Lucia range, is very free from impurities.

North of Peach Tree Creek the pre-Cretaceous series is well developed, consisting of red and brown jasper, sandstone, glaucophane schist, and intrusives of varying character. A small area of these rocks was noted in the hills west of San Benito P. O. In fact, this series probably underlies much of this region which is now covered by the Tertiary, judging from the scattered outcrops which appear so irregularly. The granite axis of the Gavilan has been the scene of the eruption of a number of masses of acid lavas. The most southerly one exposed is about 4 miles west of Parkfield, on the borders of Cholame Valley. There the lavas are all fine-grained and stony, with interstratified layers of obsidian. The rock is evidently acid enough to be classed with the liparites.

The Chalone Peaks form the southern termination of the Gavilan range. The south peak lies at the western extremity of a body of both massive and banded liparite which stretches north for about 6 miles.

with a width of 2½ miles. The peak has an elevation of about 3,000 ft., descending very abruptly to the west and south, and gradually to the north. Although the whole body seems to belong to the acid series, yet there is a great variety of crystallization products. Obsidian is abundant on the peak as well as in a cañon on the eastern side of the flow. This liparite is particularly interesting on account of containing gold, apparently as an original constituent. There are no signs of a crater, for the amount of erosion since the flow took place must have been enormous, yet everything points to the fact that the matter welled up through fissures, not all at once, but under different conditions and at different times. An immense mass of volcanic tufa stretches along the western side of the solid lavas. It forms the north Chalone Peak, which rises fully 100 ft. higher than any present existing lava. The extent to the north is about 8 miles, considerably beyond any of the lava in place. The tufa dips west at an angle varying from 30° to 60°. The northern portion has been eroded into deep cañons and high jagged pinnacles,

Fig. 17.



rising hundreds of feet. One fork of Chalone Creek has cut across the tufa, exposing cliffs nearly 600 ft. high, and which, owing to some peculiarity of structure, weather vertically. The total thickness of the tufas cannot be less than 6,000 ft. They are made up wholly, except at the base, where some granitic gravels are mixed with the volcanic, of more or less rounded bowlders of the lava, cemented by a sand of the same material. The relation to the Tertiary indicates that the lavas and tufas are older. *Fig. 17* gives a section of the Chalone Peaks.

Another eruption of liparite appears at the northern end of the range, extending from Mr. Flint's ranch over the summit where the old stage road crosses and some distance down on the western slope. This has a uniform coarse texture. Where the road crosses, the liparite appears to be intruded through sandstone, which is probably of Chico age. The sandstone is much metamorphosed near the liparite and steeply inclined.

SUMMARY OF THE VIEWS DISCUSSED IN THE FOREGOING NOTES.

There exists in the central and southern coast ranges granitic axes associated with crystalline schists and metamorphic limestone, all of unknown age. Structurally, the crystalline axes, more particularly that represented by the San José, Santa Lucia, and intermediate occurrences, are the northwest prolongation ef the San Emedio range. Tentatively, it may be assumed that the crystalline schists and limestones are of Palæozoic age, and the intruded granite of the same age as the greater portion of the San Bernardino and Peninsula ranges. These rocks are

the oldest known in the coast ranges and form the basement complex upon which the other formations have been successively laid down.

Topographically these ancient rocks are not prominent, save in a few cases, but constitute what might be called a depressed mountain system, of which only the more prominent portions project through the later coverings. It is probable that during early Mesozoic times this mountain system was far more elevated than at present, and that before the lowest uncrystalline sedimentary rocks which have been found were deposited, there was a long interval of erosion, following which a subsidence took place, which was so extreme that very little, if any, land existed through the coast ranges. Following this event the formation which has been variously termed the Metamorphic, Metamorphic-Cretaceous, and pre-Cretaceous, was deposited. Through an extent of 500 miles, and perhaps more, from southeast to northwest, the sedimentary rocks of this series appear. They consist of jasper or phthanite, gray sandstone, conglomerate, and shale or slate when not deformed by crushing. The series has been somewhat metamorphosed, particularly toward the north, where appear mica and hornblende schists. The characteristic metamorphism of the series as a whole, and one which distinguishes it lithologically from all the other formations of the Coast Range, is a chemical one, more pronounced where dynamical effects have been strongest.

This consists in a silicification of all but the softest and more impenetrable argillaceous rocks in the form of interlacing quartz veinlets from microscopic size upward. This is evidently the result of an intense crushing together of the sedimentary strata as well as of the underlying crystalline rocks, filling them with innumerable fractures, through which silicious solutions from the deeper-seated acid rocks percolated; the chemical action being induced on so large a scale by the heat generated, which, however, was not sufficient to produce fusion. Very rarely in the coast ranges is this peculiar metamorphism apparent in any of the succeeding formations, save in the immediate vicinity of the hot springs in the quicksilver regions. The silicification is more pronounced in the harder and more brittle strata. The crushing was so intense that over much of the region under discussion no system of regular folds has yet been made out. The more brittle strata have been fractured, the pliable contorted, and the soft crushed. As this regional silicification has been demonstrated on good evidenee to be confined to a series of rocks underlying unconformably the Knoxville, the lowest recognized Cretaceous, and as this boundary line between the Lower Cretaceous and the Upper Jurassic is supposed on good evidence to represent the period of intrusion of the great mass of Mesozoic granite of the Sierra Nevada, it seems highly probable that an action of so intense a character in the adjoining range was the accompaniment and partial agent in the elevation and crushing together of the Coast Range axis, resulting in the silicification described. As far as we yet know this important mountain movement in the coast ranges was not accompanied by granite south of the Klamath Mountain region.

This series of rocks so strongly marked, lithologically, is also characterized by great numbers of intrusives, which are not known to penetrate any of the younger formations. These have undergone the same deformation as the series through which they were erupted, and in most cases their original character cannot be determined by the unaided eye.

All that we can say of them is that they are older than the Knoxville, and, perhaps, in part, antedate the period of intense dynamical metamorphism. Although they may not differ in composition from the eruptives in the Cretaceous, yet, in their present physical character, are generally quite easily distinguished.

Mr. J. S. Diller has recently obtained good evidence that the whole body of Cretaceous north of the 40th parallel is one continuous series of sediments without important physical break. Although to the south no such systematic study of the Cretaceous has been attempted, yet it would seem highly probable from the evidence at hand that the same conditions which obtained in the northern coast ranges during the Cretaceous must have existed without any great modification throughout the whole extent of those ranges. The writer believes that as far as the geological history of the Pacific Coast has been unfolded, no important mountain movements have been shown to be local. Consequently, in studying the rocks of Cretaceous age through the central and southern coast region, wherever we find any portion of the Cretaceous resting unconformably on a basement series of different character, and more or less metamorphosed, it may, with reasonable certainty, be postulated that such a break is good evidence of at least a pre-Knoxville series, and if the Knoxville be continued to be considered the base of the Cretaceous, then of a pre-Knoxville series. Not only have excellent examples of this pre-Knoxville unconformity in the region studied by Mr. Diller, which are included by him in the Klamath Mountains, but also only a short distance to the south in Lake and Napa counties the same has been noted by the writer; while fully 400 miles to the southeast, in almost the extreme southern portion of the coast ranges proper, in the cañon of the Santa Maria, the same unconformity has been noted. Many almost as strongly marked occurrences of a similar nature were observed in San Luis Obispo and Monterey counties. In fact, Dr. Becker, in studying the geology of the New Idria District, demonstrated that the Chico rests unconformably on an older formation, which he considered Lower Cretaceous, but which, in the light of Mr. Diller's studies, as well as those of the writer, must be referred to a pre-Cretaceous series. This proof for the existence of a pre-Cretaceous series should not be, and is not, based on the fact of the Chico having been found unconformable above an older series, for, according to the opinion of the writer, a small unconformity exists in the Cretaceous, but upon the strongly contrasted lithological character.

There is one fact which has been seemingly overlooked in a study of the Cretaceous, and that is the presence in it of innumerable bodies of serpentine from Santa Barbara County to the Oregon line. It is found, according to all recorded observations, to penetrate the pre-Cretaceous basement rocks in both coast ranges and Sierra, and wherever the Knoxville is present that too has been intruded, but the writer cannot find any record of its having been found in the Upper Cretaceous. This fact must necessarily indicate a considerable disturbance at some time during the Cretaceous period. Judging from the physical character of the serpentine, as well as its position stratigraphically, it must have been intruded at about the same time over a large part of the State. In San Luis Obispo County the serpentine occurs intrusive in *Aucella*-bearing shales, but in a number of instances it was distinctly seen to underlie the Chico.

The Lower Cretaceous is generally characterized by dark shale and a subordinate amount of sandstone and conglomerate and small bodies of limestone, while in the Chico sandstone and conglomerates predominate.

Succeeding the uplift, crushing, and metamorphism of the pre-Cretaceous, a subsidence took place, which, without any break save for the eruption of the serpentine, continued through to the close of that period. In Central and Southern California the sedimentation has been recognized as continuing through the Eocene, but in Oregon, according to Diller, a break separates the Cretaceous and the Tertiary.

At the close of the Chico submergence in Central and Southern California but little if any land existed in the Coast Range region. Following the Cretaceous and Eocene in this region it is probable that a considerable elevation took place accompanied by a folding of this series. After a period of erosion a subsidence again took place to an extent almost as great as during the Cretaceous. On the eroded Cretaceous, pre-Cretaceous, and granitic rocks a great thickness of Miocene was laid down. This latter formation consists of sandstone and conglomerates, light-colored banded slates, and gypsum-bearing clays. At the close of the Miocene another upheaval took place, which elevated portions of the coast ranges over 5,000 ft. This is particularly noticeable in the southern coast ranges, in Santa Barbara and northern Ventura counties. Post-Pliocene movements have also been very pronounced.

[NOTE.—Since the plates were prepared for this reconnoissance report on the southern coast ranges, the conclusion has been reached that the fossils which were at first supposed to be Tejon are probably Chico. It seems then, according to our present knowledge, that the Tejon is not recognized with certainty in the region described. The reader is asked to consider all references to the Chico-Tejon in the sketches as meaning Chico.]

APPENDIX.

State Mining Bureau Act.

Mine Bell Signal Act.

Act defining Hydraulic Mining.

Debris Commissioner Act.

The Caminetti Act.

APPENDIX.

STATE MINING BUREAU ACT.

CHAPTER CLXXIII.—*An Act to provide for the establishment, maintenance, and support of a bureau, to be known as the State Mining Bureau; and for the appointment and duties of a Board of Trustees, to be known as the Board of Trustees of the State Mining Bureau, who shall have the direction, management, and control of said State Mining Bureau, and to provide for the appointment, duties, and compensation of a State Mineralogist, who shall perform the duties of his office under the control, direction, and supervision of the Board of Trustees of the State Mining Bureau.*

[Approved March 23, 1893.]

The People of the State of California, represented in Senate and Assembly, do enact as follows:

SECTION 1. There shall be, and there is hereby, established in the State of California a Mining Bureau, the principal office of which shall be maintained in the city of San Francisco, which said Mining Bureau shall be under the supervision of a Board of Trustees, to be known as the Board of Trustees of the State Mining Bureau; and it shall be the duty of, and the Governor of the State of California is hereby authorized and empowered to appoint five residents and citizens of the State to be such Trustees.

SEC. 2. The appointees shall take the same oath of office as other State officers, and when duly qualified and assembled shall constitute the Board of Trustees of the State Mining Bureau. They shall hold office for four years from the date of their appointment, or until the qualification of their successors, and shall receive no compensation for their services. They shall have control of all properties and funds of said Bureau, and shall have the power, by the name of said Board, to sue and defend. Three of them shall constitute a quorum for the transaction of business. They shall elect one of their number to be President of said Board, and shall keep a record of their proceedings. They shall adopt rules and regulations for their government not in conflict with the laws of the State.

SEC. 3. It shall be the duty of the Governor of the State of California, and he is hereby empowered, to appoint a citizen and resident of this State, having a practical and scientific knowledge of mining and mineralogy, to the office of State Mineralogist, which office is hereby created. Said State Mineralogist shall hold his office for the term of four years from the date of his appointment, or until the qualification of his successor. He shall take and subscribe the same oath of office as the other State officers, and shall give bond for the faithful performance of his

duties in the sum of twenty-five thousand dollars, said bond to be approved by the Governor of the State of California. He shall receive for his services a salary of two hundred and fifty dollars per month, to be paid in the same manner as the salaries of other State officers, and shall also receive his necessary traveling expenses when traveling on the business of his office, said expenses, when approved by the Board of Trustees of the Mining Bureau, to be allowed and audited by the State Board of Examiners. The said salary and expenses shall be paid out of the Mining Bureau Fund, herein provided for, and not otherwise.

SEC. 4. It shall be the duty of said State Mineralogist to make, facilitate, and encourage special studies of the mineral resources and mineral industries of the State. It shall be his duty to collect statistics concerning the occurrence of the economically important minerals and the methods pursued in making their valuable constituents available for commercial use; to make a collection of typical geological and mineralogical specimens, especially those of economic or commercial importance, such collection constituting the Museum of the State Mining Bureau; to provide a library of books, reports, and drawings bearing upon the mineral industries, the sciences of mineralogy and geology, and the arts of mining and metallurgy, such library constituting the Library of the State Mining Bureau; to make a collection of models, drawings, and descriptions of the mechanical appliances used in mining and metallurgical processes; to preserve and so maintain such collections and library as to make them available for reference and examination and open to public inspection at reasonable hours; to maintain, in effect, a bureau of information concerning the mineral industries of this State, to consist of such collections and library, and to arrange, classify, catalogue, and index the data therein contained, in a manner to make the information available to those desiring it, and to provide a custodian specially qualified to promote this purpose; to make a biennial report to the Board of Trustees of the Mining Bureau, setting forth the important results of his work, and to issue from time to time such bulletins as he may deem advisable concerning the statistics and technology of the mineral industries of this State.

SEC. 5. Said State Mineralogist shall have the right to appoint competent assistants and qualified specialists when necessary in the execution of his plans, and fix their compensations; but all such appointments and compensations shall be subject to the approval and confirmation of said Board of Trustees, and shall not become effective unless so confirmed and approved. And it shall be the duty of the State Mineralogist to consult the said Board of Trustees upon all matters appertaining to his official duties, and he shall at all times perform such duties subject to the supervision and approval of said Board of Trustees.

SEC. 6. It shall be the duty of the Board of Trustees of the State Mining Bureau, when the funds of said Mining Bureau will permit, to procure and maintain the necessary rooms and furniture for the offices and uses of the said Board of Trustees and the State Mineralogist, and the museum and library of the Mining Bureau, in San Francisco; *provided, however*, that the entire expenses of the State Mining Bureau for salaries, assistance, light, rent, fuel, furniture, and all other things pertaining to said Bureau, must not, in any one year, be greater than can be paid out of the Mining Bureau Fund herein provided.

SEC. 7. The Board of Trustees of the State Mining Bureau shall manage and control all the finances of said Mining Bureau, and shall make rules regulating the custody and disbursement of the funds of the State Mining Bureau, and the mode of drawing the same from the State Treasury.

SEC. 8. The Board of Trustees of the State Mining Bureau shall biennially report to the Governor of the State the condition of the Bureau, with a statement of the receipts and disbursements in detail, and with said report shall be incorporated the biennial report of the State Mineralogist, and the report of said Board of Trustees and State Mineralogist shall be printed as are the reports of the other State officers.

SEC. 9. The Board of Trustees of the State Mining Bureau are hereby empowered and authorized to receive, on behalf of the State, for the use and benefit of the State Mining Bureau, gifts, bequests, devises, and legacies of real or other property, and to use the same in accordance with the wishes of the donors; and if no instructions are given by said donors, to manage, use, and dispose of the said gifts, bequests, and legacies for the best interests of the said Mining Bureau in the manner they may deem proper.

SEC. 10. The State Mineralogist may, with the approval of the Board of Trustees of the State Mining Bureau, prepare a special collection of ores and minerals of California, to be sent to any World's Fair or Exposition at which they may deem it advisable or desirable to display the mineral wealth of the State.

SEC. 11. The Mining Bureau Fund herein mentioned, and out of which all the expenses of the State Mining Bureau shall be paid, shall consist of such property or moneys as may come into the hands of the Board of Trustees of said Bureau by gift, bequest, devise, or legacy; of such moneys as may, from time to time, be appropriated by the Legislature of the State for the use of said Bureau, and of such moneys as shall be paid into the State Treasury for the use and benefit of said Bureau, as provided in the following section.

SEC. 12. It shall be the duty of the Tax Collectors in the several counties in the State, and of the License Collector of the City and County of San Francisco, on the second Monday in January, April, July, and October, in each year, to transmit by express, to the State Treasury, all moneys collected by them from mining corporations, or from corporations formed for milling ores or for supplying water for mining purposes, under or by virtue of the Act entitled "An Act imposing a tax on the issue of certificates of stock corporations," approved April first, eighteen hundred and seventy-eight, and to forward to the State Controller, by mail, a certificate showing the amount of money so forwarded to the State Treasurer, and the date when the same was transmitted, and also showing the names of the several corporations from which the same was received, and the amount received from each. The State Treasurer shall receive the amounts so transmitted, and give duplicate receipts therefor, one of which shall be filed with the State Controller, and the other shall be forwarded to the Collector from whom the money was received; and after paying, out of the money so received, the charges for the transmission thereof, the amount of which shall be noted on the receipt filed with the State Controller, he shall retain the remainder in his hands and place it in the Mining Bureau Fund, said

Mining Bureau Fund to be used only in the payment of drafts made for the expenses of the Mining Bureau established under this Act.

SEC. 13. Such Tax Collectors and License Collectors shall hereafter be required to pay into the County Treasuries of their respective counties only that portion of the moneys collected by them under the Act of Legislature mentioned in the last preceding section, approved April first, eighteen hundred and seventy-eight, which is collected from corporations other than those mentioned in section twelve of this Act.

SEC. 14. The Board of Trustees now known as the Board of Trustees of the State Mining Bureau shall perform the duties of the Board of Trustees of the State Mining Bureau, as in this Act provided, and administer the affairs of the State Mining Bureau, as in this Act provided, until the appointment and qualification of their successors, as in this Act provided; and the State Mineralogist now performing the duties of the office of State Mineralogist shall perform the duties of the office of State Mineralogist, as in this Act provided, until the appointment and qualification of his successor, as in this Act provided.

SEC. 15. The Act entitled "An Act to provide for the establishment and maintenance of a Mining Bureau," approved April sixteenth, eighteen hundred and eighty, and the Act entitled "An Act supplementary to an Act entitled 'An Act for the establishment and maintenance of a Mining Bureau,' approved April sixteenth, eighteen hundred and eighty," approved March twenty-first, eighteen hundred and eighty-five, and all Acts and parts of Acts in conflict with the provisions of this Act, are hereby repealed.

SEC. 16. This Act shall take effect and be in force from and after its passage.

ACT ESTABLISHING A SYSTEM OF MINE BELL SIGNALS.

CHAPTER LXXIV.—*An Act to establish a uniform system of mine bell signals, to be used in all the mines operated in the State of California, and for the protection of miners.*

[Approved March 8, 1893.]

The People of the State of California, represented in Senate and Assembly, do enact as follows:

SECTION 1. Every person, company, corporation, or individual, operating any mine within the State of California—gold, silver, copper, lead, coal, or any other metal or substance—where it is necessary to use signals by means of bell or otherwise, for shafts, inclines, drifts, crosscuts, tunnels, and underground workings, shall, after the passage of this bill, adopt, use, and put in force the following system or code of mine bell signals, as follows:

1 bell, to hoist. (See Rule 2.)
1 bell, to stop if in motion.
2 bells, to lower. (See Rule 2.)
3 bells, man to be hoisted; run slow. (See Rule 2.)
4 bells, start pump if not running, or stop pump if running.
1—3 bells, start or stop air compressor.

5 bells, send down tools. (See Rule 4.)
6 bells, send down timbers. (See Rule 4.)
7 bells, accident; move bucket or cage by verbal orders only.
1—4 bells, foreman wanted.
2—1—1 bells, done hoisting until called.
2—1—2 bells, done hoisting for the day.
2—2—2 bells, change buckets from ore to water, or vice versa.
3—2—1 bells, ready to shoot in the shaft. (See Rule 3.)
Engineer's signal, that he is ready to hoist, is to raise the bucket or cage two feet and lower it again. (See Rule 3.)
Levels shall be designated and inserted in notice hereinafter mentioned. (See Rule 5.)

SEC. 2. For the purpose of enforcing and properly understanding the above code of signals, the following rules are hereby established:

Rule 1. In giving signals make strokes on bell at regular intervals. The bar (—) must take the same time as for one stroke of the bell, and no more. If timber, tools, the foreman, bucket, or cage are wanted to stop at any level in the mine, signal by number of strokes on the bell, number of the level first before giving the signal for timber, tools, etc. Time between signals to be double bars (— —). Examples:
6— —5 would mean stop at sixth level with tools.
4— —1—1—1— —1, would mean stop at fourth level, man on, hoist.
2— —1—4 would mean stop at second level with foreman.

Rule 2. No person must get off or on the bucket or cage while the same is in motion. When men are to be hoisted give the signal for men. Men *must* then get on bucket or cage, *then* give the signal to hoist. Bell cord must be in reach of man on the bucket or cage at stations.

Rule 3. After signal "Ready to shoot in shaft," engineer must give his signal when he is ready to hoist. Miners must then give the signal of "Men to be hoisted," then "spit fuse," get into the bucket, and give the signal to hoist.

Rule 4. All timbers, tools, etc., "longer than the depth of the bucket," to be hoisted or lowered, must be securely lashed at the upper end to the cable. Miners must know they will ride up or down the shaft without catching on rocks or timbers and be thrown out.

Rule 5. The foreman will see that one printed sheet of these signals and rules for each level and one for the engine-room are attached to a board not less than twelve inches wide by thirty-six inches long, and securely fasten the board up where signals can be easily read at the places above stated.

Rule 6. The above signals and rules must be obeyed. Any violation will be sufficient grounds for discharging the party or parties so doing. No person, company, corporation, or individuals operating any mine within the State of California, shall be responsible for accidents that may happen to men disobeying the above rules and signals. Said notice and rules shall he signed by the person or superintendent having charge of the mine, who shall designate the name of the corporation or the owner of the mine.

SEC. 3. Any person or company failing to carry out any of the provisions of this Act shall be responsible for all damages arising to or incurred by any person working in said mine during the time of such failure.

SEC. 4. This Act shall take effect immediately.

ACT DEFINING HYDRAULIC MINING.

CHAPTER CCXXIII.—*An Act to amend an Act entitled an Act to establish a Civil Code, approved March 21, 1872, by adding thereto two sections, to be known as sections one thousand four hundred and twenty-four and one thousand four hundred and twenty-five, being title nine, part four, division two, of said Code, concerning the manner of conducting the business of hydraulic mining.*

[Approved March 24, 1893.]

The People of the State of California, represented in Senate and Assembly, do enact as follows:

1. The Civil Code of the State of California is hereby amended by adding thereto a new title, to be known as title nine, of part four, of division two, of said Code, to read as follows:

TITLE IX—HYDRAULIC MINING.

1424. The business of hydraulic mining may be carried on within the State of California wherever and whenever the same can be carried on without material injury to the navigable streams, or the lands adjacent thereto.

1425. Hydraulic mining, within the meaning of this title, is mining by means of the application of water, under pressure, through a nozzle, against a natural bank.

DEBRIS COMMISSIONER ACT.

CHAPTER CCXXVIII.—*An Act to provide for the appointment, duties, and compensation of a Debris Commissioner, and to make an appropriation to be expended under his directions in the discharge of his duties as such Commissioner.*

[Approved March 24, 1893.]

The People of the State of California, represented in Senate and Assembly, do enact as follows:

SECTION 1. The Governor of the State of California shall, on or before the first day of January, eighteen hundred and ninety-four, appoint a competent civil engineer for a period of four years only, to be known as and called the Debris Commissioner.

SEC. 2. Said Commissioner shall, during the time he shall be actually employed in the discharge of his official duties, receive a compensation of three hundred dollars per month and his necessary traveling expenses, to be allowed by the State Board of Examiners.

SEC. 3. Whenever any Board of Engineers of the United States Government shall have been appointed, with power to adopt plans and specifications for the construction of works for the impounding of mining debris, it shall be the duty of said Debris Commissioner to consult and advise with such Board of Engineers of the United States Govern-

ment, and to examine and pass upon the merits of such works, and said Debris Commissioner shall determine whether or not such works are calculated to and sufficient to protect the navigable waters of the State, and to keep a record of such determinations.

SEC. 4. There is hereby appropriated out of the General Fund of the Treasury of this State not otherwise appropriated, the sum of two hundred and fifty thousand dollars, no warrant against said sum to be drawn or paid until the United States Government shall have appropriated at least an equal amount, to be used in the construction of works for the restraining or impounding of mining debris in California. Said moneys to be paid only upon orders drawn by the Controller, upon the written request of the said Debris Commissioner, and to be drawn only for the payment of not more than one half of the cost of the construction of any such works for restraining and impounding mining debris as shall have been approved by him and duly adopted and recommended by engineers of the United States Government appointed for that purpose.

SEC. 5. The term of office of said Debris Commissioner shall be four years from the date of his appointment. He shall take the same oath of office as is provided by law for other State officers, and before entering upon the discharge of his duties shall give bond, with sufficient sureties, to be approved by the Governor of the State, in the sum of fifty thousand dollars, for the faithful discharge of his duties as such officer.

SEC. 6. The said Debris Commissioner shall have the power to appoint a Secretary, at a monthly salary to be fixed by said Commissioner, not exceeding one hundred and twenty-five dollars per month; said Secretary to hold office at the pleasure of the said Commissioner; *provided, however*, that no Secretary shall be appointed until said Debris Commissioner shall enter upon the actual discharge of his duties.

SEC. 7. All expenditures authorized by the provisions of this Act shall be subject to the approval of the State Board of Examiners; and the State Controller is hereby authorized to draw his warrant for all expenditures not in excess of the appropriation herein provided for, so approved by the State Board of Examiners, and the State Treasurer is hereby directed to pay the same.

THE CAMINETTI LAW.

An Act to create the California Debris Commission and regulate hydraulic mining in the State of California.

[Approved March 1, 1893.]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That a commission is hereby created, to be known as the California Debris Commission, consisting of three members. The President of the United States shall, by and with the advice and consent of the Senate, appoint the commission from officers of the Corps of Engineers, United States Army. Vacancies occurring therein shall be filled in like manner. It shall have the authority, and exercise the powers hereinafter set forth, under the supervision of the Chief of Engineers and direction of the Secretary of War.

SEC. 2. That said commission shall organize within thirty days after its appointment by the selection of such officers as may be required in the performance of its duties, the same to be selected from the members thereof. The members of said commission shall receive no greater compensation than is now allowed by law to each, respectively, as an officer of said Corps of Engineers. It shall also adopt rules and regulations, not inconsistent with law, to govern its deliberations and prescribe the method of procedure under the provisions of this Act.

SEC. 3. That the jurisdiction of said commission, in so far as the same affects mining carried on by the hydraulic process, shall extend to all such mining in the territory drained by the Sacramento and San Joaquin river systems in the State of California. Hydraulic mining, as defined in section eight hereof, directly or indirectly injuring the navigability of said river systems, carried on in said territory other than as permitted under the provisions of this Act, is hereby prohibited and declared unlawful.

SEC. 4. That it shall be the duty of said commission to mature and adopt such plan or plans, from examinations and surveys already made and from such additional examinations and surveys as it may deem necessary, as will improve the navigability of all the rivers comprising said systems, deepen their channels and protect their banks. Such plan or plans shall be matured with a view of making the same effective as against the encroachment of and damage from debris resulting from mining operations, natural erosion, or other causes, with a view of restoring, as near as practicable and the necessities of commerce and navigation demand, the navigability of said rivers to the condition existing in eighteen hundred and sixty, and permitting mining by the hydraulic process, as the term is understood in said State, to be carried on, provided the same can be accomplished without injury to the navigability of said rivers or the lands adjacent thereto.

SEC. 5. That it shall further examine, survey, and determine the utility and practicability, for the purposes hereinafter indicated, of storage sites in the tributaries of said rivers and in the respective branches of said tributaries, or in the plains, basins, sloughs, and tule and swamp lands adjacent to or along the course of said rivers, for the storage of debris or water or as settling reservoirs, with the object of using the same by either or all of these methods to aid in the improvement and protection of said navigable rivers by preventing deposits therein of debris resulting from mining operations, natural erosion or other causes, or for affording relief thereto in flood-time and providing sufficient water to maintain scouring force therein in the summer season; and in connection therewith to investigate such hydraulic and other mines as are now or may have been worked by methods intended to restrain the debris and material moved in operating such mines by impounding dams, settling reservoirs, or otherwise, and in general to make such study of and researches in the hydraulic mining industry as science, experience, and engineering skill may suggest as practicable and useful in devising a method or methods whereby such mining may be carried on as aforesaid.

SEC. 6. That the said commission shall from time to time note the conditions of the navigable channels of said river systems by cross-section surveys or otherwise, in order to ascertain the effect therein of such hydraulic mining operations as may be permitted by its orders and such as is caused by erosion, natural or otherwise.

SEC. 7. That said commission shall submit to the Chief of Engineers, for the information of the Secretary of War, on or before the fifteenth day of November of each year, a report of its labors and transactions, with plans for the construction, completion, and preservation of the public works outlined in this Act, together with estimates of the cost thereof, stating what amounts can be profitably expended thereon each year. The Secretary of War shall thereupon submit same to Congress on or before the meeting thereof.

SEC. 8. That for the purposes of this Act "hydraulic mining" and "mining by the hydraulic process" are hereby declared to have the meaning and application given to said terms in said State.

SEC. 9. That the individual proprietor or proprietors, or in case of a corporation its manager or agent appointed for that purpose, owning mining ground in the territory in the State of California mentioned in section three hereof, which it is desired to work by the hydraulic process, must file with said commission a verified petition, setting forth such facts as will comply with law and rules prescribed by said commission.

SEC. 10. That said petition shall be accompanied by an instrument duly executed and acknowledged, as required by the law of the said State, whereby the owner or owners of such mine or mines surrender to the United States the right and privilege to regulate by law, as provided in this Act, or any law that may hereafter be enacted, or by such rules and regulations as may be prescribed by virtue thereof, the manner and method in which the debris resulting from the working of said mine or mines shall be restrained, and what amount shall be produced therefrom; it being understood that the surrender aforesaid shall not be construed as in any way affecting the right of such owner or owners to operate said mine or mines by any other process or method now in use in said State; *provided*, that they shall not interfere with the navigability of the aforesaid rivers.

SEC. 11. That the owners of several mining claims situated so as to require a common dumping ground or dam or other restraining works for the debris issuing therefrom in one or more sites, may file a joint petition setting forth such facts, in addition to the requirements of section nine hereof; and where the owner of a hydraulic mine or owners of several such mines have and use common dumping sites for impounding debris or as settling reservoirs, which sites are located below the mine of an applicant not entitled to use same, such fact shall also be stated in said petition. Thereupon the same proceedings shall be had as provided for herein.

SEC. 12. A notice specifying briefly the contents of said petition, and fixing a time previous to which all proofs are to be submitted, shall be published by said commission in some newspaper or newspapers of general circulation in the communities interested in the matter set forth therein. If published in a daily paper, such publication shall continue for at least ten days; if in a weekly paper, in at least three issues of the same. Pending publication thereof said commission, or a committee thereof, shall examine the mine and premises described in such petition. On or before the time so fixed all parties interested, either as petitioners or contestants, whether miners or agriculturists, may file affidavits, plans, and maps in support of their respective claims. Further hearings, upon notice to all parties of record, may be granted by the commission when necessary.

SEC. 13. That in case a majority of the members of said commission, within thirty days after the time so fixed, concur in a decision in favor of the petitioner or petitioners, the said commission shall thereupon make an order directing the methods and specifying in detail the manner in which operations shall proceed in such mine or mines; what restraining or impounding works, if facilities therefor can be found, shall be built, and maintained; how and of what material; where to be located; and in general set forth such further requirements and safeguards as will protect the public interests and prevent injury to the said navigable rivers, and the lands adjacent thereto; with such further conditions and limitations as will observe all the provisions of this Act in relation to the working thereof and the payment of taxes on the gross proceeds of the same; *provided*, that all expense incurred in complying with said order shall be borne by the owner or owners of such mine or mines.

SEC. 14. That such petitioner or petitioners must within a reasonable time present plans and specifications of all works required to be built in pursuance of said order, for examination, correction, and approval by said commission; and thereupon work may immediately commence thereon under the supervision of said commission or representative thereof attached thereto from said Corps of Engineers, who shall inspect same from time to time. Upon completion thereof, if found in every respect to meet the requirements of the said order and said approved plans and specifications, permission shall thereupon be granted to the owner or owners of such mine or mines to commence mining operations, subject to the conditions of said order and the provisions of this Act.

SEC. 15. That no permission granted to a mine owner or owners under this Act shall take effect, so far as regards the working of a mine, until all impounding dams or other restraining works, if any are prescribed by the order granting such permission, have been completed and until the impounding dams or other restraining works or settling reservoirs provided by said commission have reached such a stage as, in the opinion of said commission, it is safe to use the same; *provided, however*, that if said commission shall be of the opinion that the restraining and other works already constructed at the mine or mines shall be sufficient to protect the navigable rivers of said systems and the work of said commission, then the owner or owners of such mine or mines may be permitted to commence operations.

SEC. 16. That in case the joint petition referred to in section eleven hereof is granted, the commission shall fix the respective amounts to be paid by each owner of such mines toward providing and building necessary impounding dams or other restraining works. In the event of a petition being filed after the entry of such order, or in case the impounding dam or dams or other restraining works have already been constructed and accepted by said commission, the commission shall fix such amount as may be reasonable for the privilege of dumping therein, which amount shall be divided between the original owners of such impounding dams or other restraining works in proportion to the amount respectively paid by each party owning the same. The expense of maintaining and protecting such joint dam or works shall be divided among mine owners using the same in such proportion as the commission shall determine. In all cases where it is practicable, restraining and impound-

ing works are to be provided, constructed, and maintained by mine owners near or below the mine or mines before reaching the main tributaries of said navigable waters.

SEC. 17. That at no time shall any more debris be permitted to be washed away from any hydraulic mine or mines situated on the tributaries of said rivers and the respective branches of each, worked under the provisions of this Act, than can be impounded within the restraining works erected.

SEC. 18. That the said commission may at any time, when the condition of the navigable rivers or when the capacities of all impounding and settling facilities erected by mine owners, or such as may be provided by Government authority, requires same, modify the order granting the privilege to mine by the hydraulic mining process so as to reduce amount thereof to meet the capacities of the facilities then in use, or if actually required in order to protect the navigable rivers from damage, may revoke same until the further notice of the commission.

SEC. 19. That an intentional violation on the part of a mine owner or owners, company, or corporation, or the agents or employés of either, of the conditions of the order granted pursuant to section thirteen, or such modifications thereof as may have been made by said commission, shall work a forfeiture of the privileges thereby conferred, and upon notice being served by the order of said commission upon said owner or owners, company, or corporation, or agent in charge, work shall immediately cease. Said commission shall take necessary steps to enforce its orders in case of the failure, neglect, or refusal of such owner or owners, company, or corporation, or agents thereof, to comply therewith, or in the event of any person or persons, company, or corporation working by said process in said territory contrary to law.

SEC. 20. That said commission, or a committee therefrom, or officer of said corps assigned to duty under its orders, shall, whenever deemed necessary, visit said territory and all mines operating under the provisions of this Act. A report of such examination shall be placed on file.

SEC. 21. That the said commission is hereby granted the right to use any of the public lands of the United States, or any rock, stone, timber, trees, brush, or material thereon or therein, for any of the purposes of this Act; that the Secretary of the Interior is hereby authorized and requested, after notice has been filed with the Commissioner of the General Land Office by said commission, setting forth what public lands are required by it under the authority of this section, that such land or lands shall be withdrawn from sale and entry under the laws of the United States.

SEC. 22. That any person or persons who willfully or maliciously injure, damage, or destroy, or attempt to injure, damage, or destroy, any dam or other work erected under the provisions of this Act for restraining, impounding, or settling purposes, or for use in connection therewith, shall be guilty of a misdemeanor, and upon conviction thereof shall be fined not to exceed the sum of five thousand dollars or be imprisoned not to exceed five years, or by both such fine and imprisonment, in the discretion of the court. And any person or persons, company, or corporation, their agents or employés, who shall mine by the hydraulic process, directly or indirectly injuring the navigable waters of the United States, in violation of the provisions of this Act, shall be

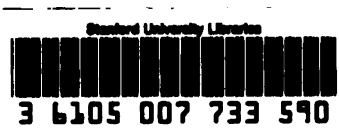
guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine not exceeding five thousand dollars, or by imprisonment not exceeding one year, or by both such fine and imprisonment, in the discretion of the court; *provided*, that this section shall take effect on the first day of May, eighteen hundred and ninety-three.

SEC. 23. That upon the construction by the said commission of dams or other works for the detention of debris from hydraulic mines and the issuing of the order provided for by this Act to any individual, company, or corporation to work any mine or mines by hydraulic process, the individual, company, or corporation operating thereunder working any mine or mines by hydraulic process, the debris from which flows into or is in whole or in part restrained by such dams or other works erected by said commission, shall pay a tax of three per centum on the gross proceeds of his, their, or its mine so worked, which tax of three per centum shall be ascertained and paid in accordance with regulations to be adopted by the Secretary of the Treasury, and the Treasurer of the United States is hereby authorized to receive the same. All sums of money paid into the Treasury under this section shall be set apart and credited to a fund to be known as the "Debris Fund," and shall be expended by said commission under the supervision of the Chief of Engineers and direction of the Secretary of War, in addition to the appropriations made by law, in the construction and maintenance of such restraining works and settling reservoirs as may be proper and necessary; *provided*, that said commission is hereby authorized to receive and pay into the Treasury from the owner or owners of mines worked by the hydraulic process, to whom permission may have been granted so to work under the provisions hereof, such money advances as may be offered to aid in the construction of such impounding dams or other restraining works, or settling reservoirs, or sites therefor, as may be deemed necessary by said commission to protect the navigable channels of said river systems, on condition that all moneys so advanced shall be refunded as the said tax is paid into the said Debris Fund; *and provided further*, that in no event shall the Government of the United States be held liable to refund same except as directed by this section.

SEC. 24. That for the purpose of securing harmony of action and economy in expenditures in the work to be done by the United States and the State of California, respectively, the former in its plans for the improvement and protection of the navigable streams, and to prevent the depositing of mining debris or other materials within the same, and the latter in its plans authorized by law for the reclamation, drainage, and protection of its lands, or relating to the working of hydraulic mines, the said commission is empowered to consult thereon with a commission of engineers of said State, if authorized by said State for said purpose, the result of such conference to be reported to the Chief of Engineers of the United States Army, and, if by him approved, shall be followed by said commission.

SEC. 25. That said commission, in order that such material as is now or may hereafter be lodged in the tributaries of the Sacramento and San Joaquin river systems resulting from mining operations, natural erosion, or other causes, shall be prevented from injuring the said navigable rivers, or such of the tributaries of either as may be navigable, and the land adjacent thereto, is hereby directed and empowered, when appropriations are made therefor by law, or sufficient money is deposited for that

purpose in said Debris Fund, to build at such points above the head of navigation in said rivers and on the main tributaries thereof, or branches of such tributaries, or at any place adjacent to the same, which, in the judgment of said commission, will effect said object (the same to be of such material as will insure safety and permanency), such restraining or impounding dams, and settling reservoirs, with such canals, locks, or other works adapted and required to complete the same. The recommendations contained in Executive Document numbered two hundred and sixty-seven, Fifty-first Congress, second session, and Executive Document numbered ninety-eight, Forty-seventh Congress, first session, as far as they refer to impounding dams, or other restraining works, are hereby adopted, and the same are directed to be made the basis of operations. The sum of fifteen thousand dollars is hereby appropriated from moneys in the Treasury not otherwise appropriated, to be immediately available to defray the expenses of said commission.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